

CONSIDERATIONS REGARDING THE MANAGEMENT OF NON-COMPLIANT WASTE LANDFILLS AND THEIR IMPACT ON THE ENVIRONMENT IN CLUJ COUNTY

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ABSTRACT. Waste management policy benefits nowadays from a major importance both internationally and nationally, being subjected to constant improvements. Also, the impact on the quality of the environmental factors and on human health leads to the special attention that waste management benefits from on a global level.

The current approach on the issue emerges from the current situation of the municipal waste landfills in Romania. The implementation of viable solutions becomes a complex problem due to the landfill disposal, being considered the last stage in the life cycle assessment of waste and also the less environmental friendly method.

This paper aims to identify and evaluate the state of non-compliant municipal waste landfills in Cluj County, in order to assess the environmental impact. The conducted study shows that a number of 6 waste landfills were stated as being non-compliant. It is noted the lack of a waste landfill deposit compliant with the legislation in force, since over 95% of the waste collected on national level ends up being stored.

Key words: *waste landfill, environmental factors, non-compliant, impact.*

INTRODUCTION

Waste management has become an issue of global concern due to the continuous rise of the population and the consumption patterns change (Marshall et al., 2013).

The marketing techniques based on excessive product packaging and oriented towards over consumption lead to the increase of the waste amount generated. Dealing with these issues constitutes a high priority at European Union level, where Romania has the status of a member.

According to the European Union statistics, Romania has registered an increase in waste generation from 341 kg/citizen/year in 2001 to 365 kg/citizen/year in 2010. The waste stored at a national level goes up to 6.2 mil. Tones in 2010, most of it being stored in waste landfills non-compliant with the European legislation. The waste storage stage is practiced to 99% in the same year (Eurostat, 2010).

The preliminary analysis of the waste management system leads to the identification of the waste storage stage which represents the highest and longest impact on the environmental factors.

Storing municipal waste in non-compliant waste landfills leads to risks and has a significant impact upon the human health and environmental factors.

According to Giusti (2009), waste storage involves a negative impact on surface water (leachate, heavy metals, synthetic organic compounds), air (CO₂, CH₄, odours, noise, VOC's- volatile organic compounds), soil (heavy metals, synthetic organic compounds), landscape (visual effect, pests) and also climate, being considered the worst long term option regarding greenhouse gases emissions (Giusti, 2009).

These conventional practices with a significant history thrive even today in many countries, prevailing those that are constantly developing, such as Romania.

The entire approach on the waste management system consists of the following stages: collection, transport, treatment, recovery and final storage. The cycle consisting of treatment and recovery of the waste through different methods such as incineration, composting, recycling or any other available methods record a low percentage compared with the percentage of the storage at a national level.

The orientation towards decreasing the amount of the waste stored represents a priority for Romania at this moment.

Financial instruments represent a barrier in achieving the best waste management techniques, as a consequence of the wrong perspective from which waste is regarded, being considered a remnant without any economical value and not a resource with exploitable potential.

Over-exploitation and expansion of the waste landfill can be credited to the abuse of the final municipal waste storage stage without a strategy of reintroducing it in the economical cycle. For this reason, the waste becomes a non-useful element, even a financial consumer.

The present research aims to identify, map draw and evaluate the state of non-compliant municipal waste landfills located in Cluj County, for the purpose of evaluating the impact generated upon the environment. There is also presented data regarding municipal waste management in Cluj County, though without being exhaustive.

MATERIALS AND METHODS

Study area

The study was conducted in Cluj County, located in the North-Western part of Romania, at the point where three representative relief units join: Apuseni Mountains group, Somesan Plateau and Transylvania Plain (Jașcău et al., 2013).

Cluj County has an administrative - territorial organisation composed of five municipalities (Turda, Dej, Câmpia Turzii, Gherla and Huedin) and the county residence (Cluj-Napoca).

Cluj County is the largest in the North-Western region and the third in the country considering the number of the resident population which was 691.1 thousand in 2011, as shown in the results of the national census in 2011.

The municipalities in Cluj County succeed depending on the number of inhabitants as follows: Cluj-Napoca municipality (324.576 inhabitants), Turda municipality (47.744 inhabitants), Dej municipality (33.497 inhabitants), Campia Turzii municipality (22.223 inhabitants), Gherla municipality (20.982 inhabitants) and Huedin city (9.346 inhabitants) (National Institute of Statistics, 2011).

Fig. 1 presents Cluj County location and the position of the municipalities mentioned above (*Gati 2013, Q-GIS Map*).

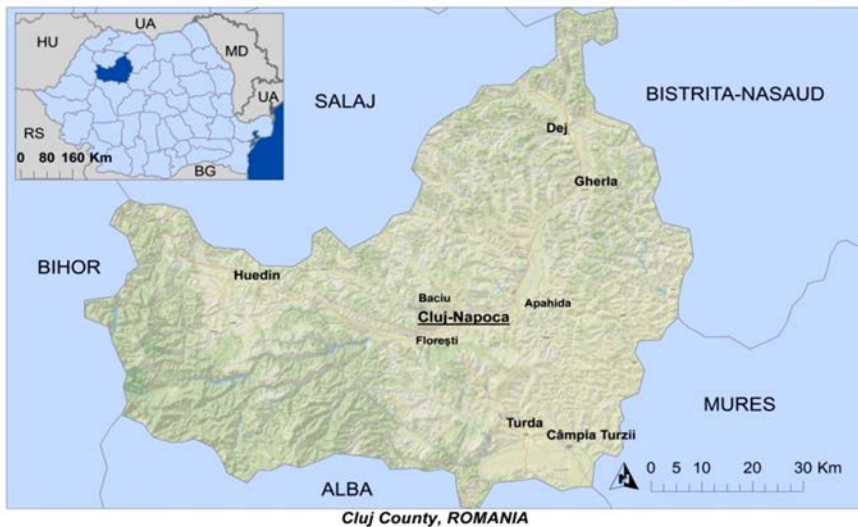


Fig. 1. Cluj County and municipalities' location

Municipal waste landfills included in the study were designed for the purpose of serving the municipalities in Cluj County. The choice of the study area took into account the current status of municipal waste landfills in Cluj County, due to the transposition of European legislation in national context which led to the adjournment of the activity of all municipal waste landfills and declaring them as non-compliant. The lack of a sanitary municipal waste landfill necessary for proper storage of waste counted in choosing the current study area.

Data analysis

The studied waste landfills were identified with the help of field research together with satellite image analysis methods. On the other hand, in order to identify and highlight the sites of interest; the GIS (Geographical Informational System) technique was used.

The map drawing of waste landfills helps analysing their location in the administrative area of Cluj County, facilitating the correlation between the functional anthropic areas. In addition, there was conducted a detailed study on the statistical data reported at European level regarding municipal waste management. The processing of the centralised data gathered by the competent authority of the EU aims to establish a situation regarding waste management in the EU countries. Furthermore, the EU data was compared to the national data in order to correlate with the current status of municipal waste management in Romania and Cluj County.

For identifying and establishing the situation of municipal waste landfills and the tendencies in managing the municipal waste in Cluj County, processing and interpretation the data with the help of specialised programs were considered for the purpose of stressing the obtained results.

RESULTS AND DISCUSSION

As a result of the studies carried out, it was found that at european level waste management tends to decrease the municipal waste storage, orienting towards new methods with a lower negative impact on human health and environmental factors.

There is a negative correlation between GDP and waste treatment methods. Countries with a high GDP (Germany, Holland, Switzerland etc.) have implemented a very efficient waste management, reducing the storage percent down to 0% compared with the countries with a low GDP (Bulgaria, Romania, Lithuania etc.), which store over 95% of the collected waste.

Fig. 2 shows the opportunity to eliminate the municipal waste storage stage from the waste management structure and also the high level of municipal waste storage in Romania (<http://epp.eurostat.ec.europa.eu>).

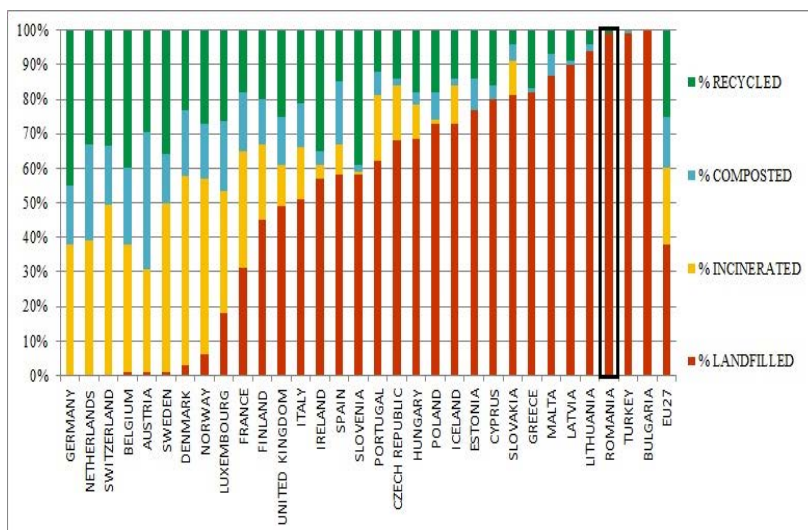


Fig. 2. Municipal waste management in European Union in 2010.

For illustrating the correlation between the final waste storage percentage and the GDP/inhabitant of the member countries of the European Union, the Pearson correlation coefficient was calculated with the help of SPSS programme (Jaba et al., 2004).

The correlation result between the final waste storage and GDP/inhabitant is negative, being inversely proportional. The Pearson-r coefficient equals -0.773 (it can take values from -1 to 1).

This result shows that the correlation is significant. Nationally, the municipal waste storage stages mainly consist of eliminating waste by storage (<http://apmcj.anpm.ro>). From the waste storage point of view, Romania has had 106 non-compliant municipal waste landfills in 2010 (<http://www.anpm.ro>). There is an intense waste storage in Cluj County, as there is no municipal waste landfill compliant with the legislation in force (<http://apmcj.anpm.ro>).

Table 1 presents the municipal waste landfills situation in Cluj County where it can be seen a difference between the activity carried out and the current declared stage (<http://apmcj.anpm.ro>). The 5 municipal waste landfills that are going to be closed expand on a total area of 19.85 ha.

After studying the references in this field, it has been noted the lack of materials that can locate the waste landfills in Cluj County. The importance of map drawing the non-compliant waste landfills in the county justifies by the necessity of identifying the affected areas that need an ecological reconstruction.

Table 1. *The municipal waste landfills situation in Cluj County*

The municipal waste landfills situation in Cluj County				
Municipality	Area [ha]	Suspending year	Current stage	Closing status
Cluj	9	2010	Suspended	Ongoing
Turda	3.2	2012	Suspended	Ongoing
Campia Turzii	5	2012	Suspended	Ongoing
Huedin	1.15	2012	Suspended	Ongoing
Gherla	1.5	2012	Suspended	Ongoing
Dej	0.4	2010	Suspended	Closure finalised

On the other hand, using maps for locating the municipal waste landfills in Cluj County is important especially for the purpose of initiating a waste management plan for the surrounding localities.

Fig. 3 was realised for simplifying the process of identifying the municipal waste landfills in Cluj County. It is also presented the position of the municipalities in the territorial area of Cluj County (*Gati 2013, Q-GIS Map*).



Fig. 3. Map drawing of the municipal waste landfills in Cluj County.

By correlating the evolution of the inhabitants number from Cluj county with the increase of the amount of waste generated (kg/capita/year) between 2001 and 2011, it can be seen the importance of consumer behaviour of the population and the efficiency of waste management.

Fig. 4 presents the evolution of the amount of waste generated measured in kg/inhabitant/year (national average) on a 10 year period of time (2001-2011), compared with the number of inhabitants in Cluj county in the years when the national census was conducted (2002 and 2011) (www.recensamantromania.ro).

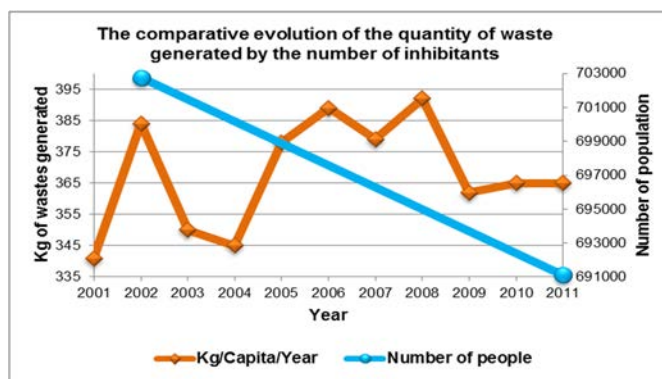


Fig. 4. The graphic representation of the evolution of the amount of waste generated (kg/inhabitant/year) compared with the evolution of the number of inhabitants.

For calculating the tons of waste generated in Cluj County between 2001 and 2011 it has been considered the number of population (702.755 inhabitants) estimated for 2001 and 691.106 inhabitants, according to the census from 2011.

Although the number of inhabitants in Cluj County decreased from 702.755 inhabitants in 2001 to 691.106 inhabitants in 2011, the amount of waste generated does not record any declines (www.cluj.insse.ro). Therefore, the amount of waste generated in 2001 in Cluj County is 2.39 mil. Tones compared to the year 2011 when 2.52 mil. Tones were generated (www.anpm.ro). This calculation shows how important the influence of the amount of waste generated is, compared with the number of inhabitants which generates with 0.13 mil. Tones more waste even though it is 11.649 inhabitants smaller.

The population in Romania also tends to decrease from 21.6 mil. inhabitants in 2002 to 20.1 mil. inhabitants in 2011 which reveals a situation similar to the one in Cluj county regarding the evolution of the amount of waste generated (<http://www.recensamantromania.ro>). Fig. 5 was made in order to highlight the evolution of the amount of waste generated, collected and stored in Cluj County (<http://epp.eurostat.ec.europa.eu>). There is a difference between the collected waste quantity and the amount of waste generated, which represents a significant percentage of waste excluded from the waste management system.

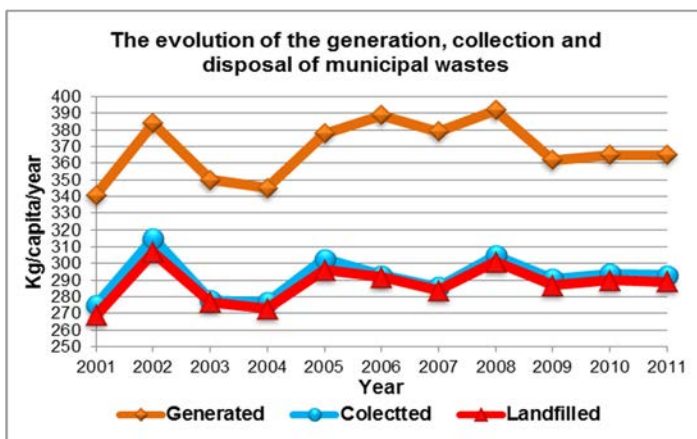


Fig. 5. *The evolution of the generation, collection and storage of municipal waste.*

The relation between the quantity of the waste collected and the stored waste is very close, which shows the high level of waste storage in the country and also in Cluj County.

CONCLUSIONS

The conducted study shows that a number of 6 municipal waste landfills have been stated as being non-compliant with the legislation in force.

It is noted the lack of a municipal waste landfill compliant with the provisions of the European directives transposed at a national level, as over 95% of the waste collected nationally ends up being stored.

Furthermore, it is concluded that the approach of some methods of waste management with a lower impact on human health and environmental factors is needed, such as rising the recycling percentage, reusing or composting against the final waste storage which represents an important pollution source for the environmental factors.

Developing projects for reconstruction and rehabilitation of polluted sites through non-compliant municipal waste storage is critical for the need to restore the affected areas and to reintroduce them in the land usage system.

The importance of selective collection of municipal waste is highlighted by the necessity of increasing the percentage of waste exploitation against the final waste storage elimination method.

On the other hand, the society's consumer behaviour regarding waste generation has a significant impact.

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