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COMPARATIVE STUDY OF EUROPEAN LEGISLATION ON LANDFILLS IN ROMANIA, BELGIUM AND FRANCE

BY

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Abstract. This study is a comparative overview of landfills in EU countries. It discusses issues related to landfill legislation and objective criteria in Romania, Belgium and France.

Rapid growth of population, urbanization of developed countries and industry growth generate a high amount of waste. Waste production tripled compared to the amount of waste produced in the 50's.

Although the percentage of recycled waste is growing, there are still many landfills built earlier that now undergo the post-management phase.

In anticipation of initiatives for reopening landfills to recover raw material stored in landfills over time, initiatives that are getting more and more widespread the North Eastern Europe (such as the European Project EAWFILL aimed to stimulate various public authorities to make decisions in this sense), it is desired to limit post-management costs, to reduce the risk of lurching and to reduce environmental pollution as much as possible, etc. For example, the latest landfill inventory conducted in the Waloon Region (Belgium) showed that around 1200 landfills are reported, yet only ten are now in use.

Keywords: landfill legislation; environmental; pollution.

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1. Introduction

Rapid growth of population, urbanization of developed countries and industry growth generate a high amount of waste. Waste production tripled compared to the amount of waste produced in the 50's.

Although the percentage of recycled waste is growing, there are still many landfills built earlier that now undergo the post-management phase.

In anticipation of initiatives for reopening landfills to recover raw material stored in landfills over time, initiatives that are getting more and more widespread the North Eastern Europe (such as the European Project EAWFILL aimed to stimulate various public authorities to make decisions in this sense), it is desired to limit post-management costs, to reduce the risk of lurching and to reduce environmental pollution as much as possible, etc. For example, the latest landfill inventory conducted in the Waloon Region (Belgium) showed that around 1200 landfills are reported, yet only ten are now in use.

2. Landfill Classification

Waste landfills in Romania are classified in accordance with GD 349/2005 and GD 162/2002.

The concept has evolved from ***simple*** (discharging residues into pits, former pits or other lands, without taking special environmental protection measures) to ***controlled*** storage, discharging waste in areas with special facilities complying with hygiene and environmental protection rules.

Modern perspective on city waste disposal takes into account compliance with hygiene and environmental protection rules and long-term storing capacity (at least 20-25 years). The landfills have a sealing system aimed to prevent the infiltration of pollutants into groundwater and a drainage system ensuring rapid discharge of the leachate to the treatment plant. Fermentation gases are collected and discharged under control or are used as a source of energy. Also, these need the installation of an adequate monitoring system.

Landfill classification may be done according to several factors:

- by waste nature [GD 349/2005 and GD 162/2002]
  - *landfills for **hazardous** waste (class a)*
  - *landfills for **non-hazardous** waste (class b)*
  - ***inert** waste landfills* (that cannot generate processes that would require collection and discharge of exfiltrated water) (class c);
- by permeability of superficial layer:
  - ***open** landfill*, the landfills whose coverage is (on the entire surface or on specific areas) permeable for water and gases;
  - ***closed** landfills**,*** the landfills whose exploitation has stopped and that have undergone the closure operations to achieve water and gas impermeability and whose location is still part of a monitoring program.

In Belgium, landfills are divided into five classes:

- class 1 – hazardous waste;
- class 2 – non-hazardous industrial waste, household waste and assimilated waste;
- class 3 – inert waste;
- class 4 – materials extracted from riverbeds, river banks and water courses, lakes after drainage and cleaning works:
    - class 4A - materials containing less pollutants (organic and inorganic compounds described in the Annex 1 and the Decision of Walloon Government of 30 November 1995) than the limit values;
    - class 4B – materials containing more pollutants (organic and inorganic compounds described in the Annex 1 and the Decision of Walloon Government of 30 November 1995) than the limit values;
- class 5 – reserved to exclusive use of a waste producer:
    - class 5.1 – hazardous waste;
    - class 5.2 – non-hazardous waste;
    - class 5.3 – inert waste.

In France, there are three types of waste landfill:

- waste landfill class 1: intended to store hazardous waste. Spillage into this type of landfills is preceded by waste analysis to be discharged;
- waste landfill class 2 : in which household and assimilated waste are stored (restaurant food scraps, etc);
- waste landfill class 3: storing inert waste: earth, gravel, concrete, etc.

3. Excerpts from Landfill-Related European Legislation

3.1. Conditions and Objective Criteria for Building Waste Landfills

The European Union

The landfills described in various directives of the European Union aim to: "*Prevent or reduce as much as possible the negative effects of waste disposal in landfills on the environment and especially on the pollution of surface water, groundwater, soil and air and on planet environment, including the greenhouse effect and the risks resulting for human health over the entire lifespan of the waste landfil*l".

At each level, the waste landfill development should comply with the following rules:

Localisation

- the shortest distance to urban, agricultural, recreation, water courses and lakes;

- the shortest distance to groundwater;
- taking into consideration the geology and hydrogeology of the area;
- taking into account the risks of flooding, erosion and land sliding.

Soil, groundwater, surface water protection

- perfect sealing of landfill bottom and sides, during and after its operation;
- surface sealing after its operation.

Water and leachate management

- Limiting water infiltration caused by rainfall into waste mass;
- Preventing surface and/or underground water from infiltration into waste;
- The accumulation of contaminated water and leachate and their treatment as to achieve the required quality to be discharged into the environment.

Biogas management

- For waste landfills storing biodegradable waste, the biogas should be captured through a network of pipes and pits;
- Biogas should be used whether for electricity production, cogeneration or burning using a burning installation if it is low in methane.

Belgium

The Decision of 27th of February 2003 (« Arrêté du Gouvernement wallon fixant les conditions sectorielles d'exploitation des centres d'enfouissement technique (Moniteur Belge of 13.03.2003)) of the Waloon Government sets the industry operation conditions for waste landfills.

Various decision articles present the minimal distances that should be considered between the location of waste landfills and other surrounding sensitive areas.

First section – minimal distances of waste landfills to specific areas from the industry plan and for specific regions

Minimal distance between the area of waste disposal and water courses or lakes is:

a) 15 m for class 3 and 5.3 waste landfills;
b) 25 m for class 2 and 5.2 waste landfills;
c) 50 m for class 1 and 5.1 waste landfills.

It is banned to locate waste landfills near any water catchment area specified in the Decision of 14th of October 1991 for drinking water catchment, near any water pumping areas, any areas for monitoring and artificial supply of groundwater.

Class 1, 2, 4-B, 5.1 and 5.2 waste landfills cannot be built in an area of distant prevention or monitored area as they are defined by Law of 14th November 1991 pertaining to drinking water catchment, near water pumping areas, areas for monitoring and artificial supply of groundwater.

Minimal distances between waste landfills and protected natural areas are:

a) 25 m for class 3, 4-A and 5.3 waste landfills;
b) 50 m for class 2, 4-B and 5.2 waste landfills;
c) 75 m for class 1 and 5.1 waste landfills.

Section two – Sealing and drainage

Any waste landfill should be built with a sealing system at the bottom and on sides and it shall have sufficient impermeability to limit soil, groundwater, and surface water contamination (Art. 10. § 1.)

To comply with these rules, landfill bottom and sides should be built using mineral and synthetic liners that meet impermeability requirements and have the necessary thickness, so that the combined effect in terms of soil, groundwater and surface water protection is at least equal to the requirement resulting from the following:

- Class 1 and 5.1 waste landfills – mineral materials $K \leq 1.0 \times 10^{-9}$ m/s thickness ≥ 5 m at base and on the sides, ≥ 1 m on the superior part of the sides, and synthetic PEHD materials, thickness ≥ 2 mm
- Class 2, 4B and 5.2. waste landfills – mineral materials $K \leq 1.0 \times 10^{-9}$ m/s thickness ≥ 1 m at base and on the sides, ≥ 0.6 m on the superior part of the sides, and synthetic PEHD materials, thickness ≥ 2 mm for class 2 and 5.2 landfills, and ≥ 1.5 mm for class 4B land fills
- Class 3, 4A and 5.3. waste landfills – mineral materials $K \leq 1 \times 10^{-7}$ m/s thickness ≥ 1 m

K = permeability coefficient

The sealing system shall have a thickness over 0.5 m, drainage materials not being considered in this calculation (Art. 11. § 1.).

For class 1, 2, 4B, 5.1. and 5.2. landfills, the sealing system at bottom and sides shall have a drainage system with a perennial permeability coefficient K equal to at least 10-2 m/s and a thickness of over 0.5 m at bottom and 0.2 m on the sides. This drainage may have some discontinuities on the upper part of the sides.

The drainage system should use fine gravel. If there is a chance of contact with acid leachate, the gravel should not be of calcareous origin. In this case, fire damage and acid attack should be less than 5%.

Prior development of waste landfill and the installation of the sealing layers and the drainage massive should be made in such a way that low accumulation of leachate at the base of waste landfill is ensured (Art. 12. § 1.).

After excavation and area reprofiling, sealing and lower drainage systems will be installed and no side can have a slope over 6/4 (33° horizontally). This slope could be adapted if needed to avoid any system tension.

The base of the waste landfill on each cell is profiled in such a way that a perennial slope of at least 2% is achieved in the direction of the main leachate collector.

In case of class 2 waste landfill (household waste), its base and sides after landfill reprofiling should be sealed to avoid bottom infiltration.

Art. 13. If, based on environmental risk assessment suggested by the operator, the competent authority estimates that the waste landfill involves no potentially significant risk for the soil, underground, underground and surface water, the requirements of articles 10, 11 and 12 mentioned above may be adapted accordingly.

Provisions for the Walloon Region

The provisions below refer to new waste landfills. For class 2 and 5.2 waste landfills, the general and backfill arrangement shall be made using a device equivalent to the requirements mentioned below:

a) mineral liner with $k < 10^{-9}$ m/s, a thickness > 1 m at the base and the lower part of the sides and a thickness of > 0.6 m in upper part of the sides;

b) PEHD synthetic materials with a thickness of > 2 mm;

c) sealing should be at least 50 cm thick. The backfill cannot have a slope over 6/4. The base should have a slope of at least 2%.

The anatomy of such landfill is presented in Fig. 1:

i) protective mineral liner $k = 10^{-3}$ m/s of 20 cm;

ii) contaminated geotextile or geogrid liner;

iii) collector liner of 50 cm: 30 cm $k = 10^{-2}$ m/s and 20 cm liner;

iv) anti-perforation geotextile liner;

v) HDPE geomembrane of minimally 2 mm;

vi) leakage collection geotextile liner;

vii) compacted clay liner of at least 1 m;

viii) prepared subgrade of approximately 15 cm.

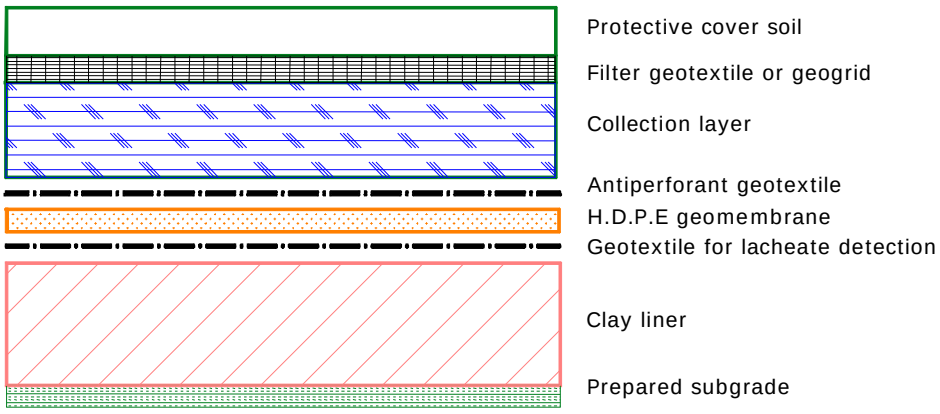

Fig. 1 – Anatomy of landfill bottom and sides.

In terms of cap system, a provisional complex system must be installed. It consists of a top soil of at least 15 cm, a collecting geosynthettic material and sewage for the recovery of biogas and a layer of the 2nd-category soils.

When the relative annual compaction rate goes under 1.5% for the entire waste landfill, the 2nd-category soil is withdrawn, the entire landfill being reprofiled with inert materials and a complex final sealing-drainage system is installed. The reference device is presented in Fig. 2:

a) 70 cm of second category soils + 30 cm of arable soil;
b) leakage geosynthetic material + rainfall water sewage;
c) PEHD geomembrane of 1.5 mm;
d) 80 cm of clay;
e) geosynthetic collector + gas sewage;
f) intermediary layer of at least 15 cm.

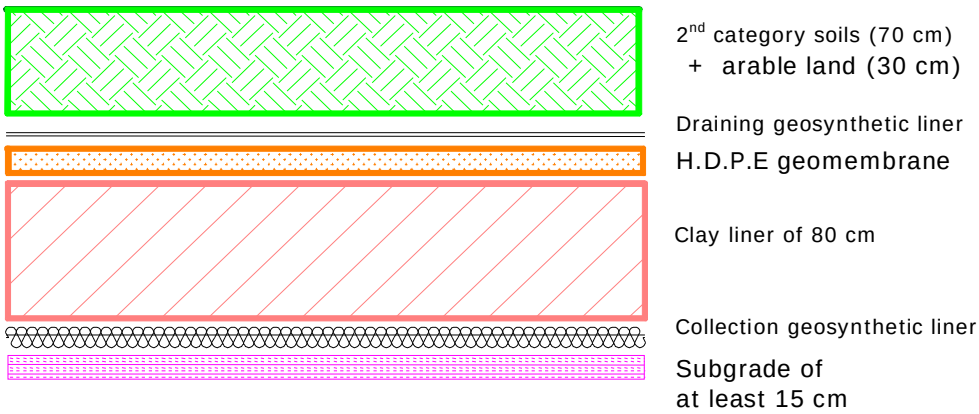

Fig. 2 – Composite cap system.

3.2. Waste Disposal

Waste disposal means disposing waste at a location. For more than 25 years, waste has been disposed of in easily compacted layers of 1,...,3 m. These were put over the existing layers as to extend the frontal side of the waste landfill. This technique called „onion sheet" (Fig. 3) has the advantage of limiting leaking and water infiltration in the waste.

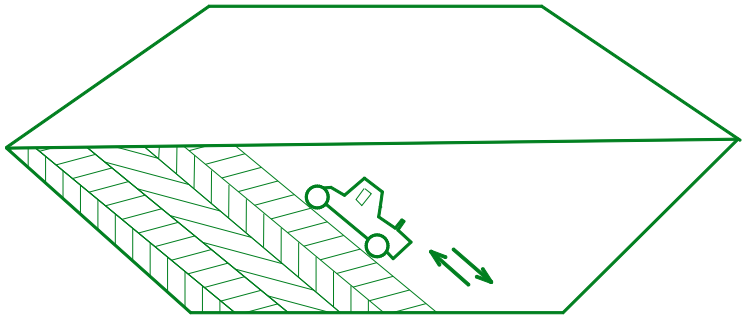

Fig. 3 – Waste disposal technique called „onion sheet".

In the 1990s, due to public aid doubled by operators's wish to increase the lifetime of waste landfills and to reduce emissions and odour, the waste disposal methods developed reducing the size of operated areas. Waste disposal centres are now subdivided into waste alveoli and cells with the average size of 2,500,...,5,000 sqm.

In most cases, waste is placed in fine layers 30-80 cm thick, compacted using special machinery (Fig. 4). This method aims to increase waste density by compression (limitation of post-management compaction) and to increase the location waste disposal capacity.

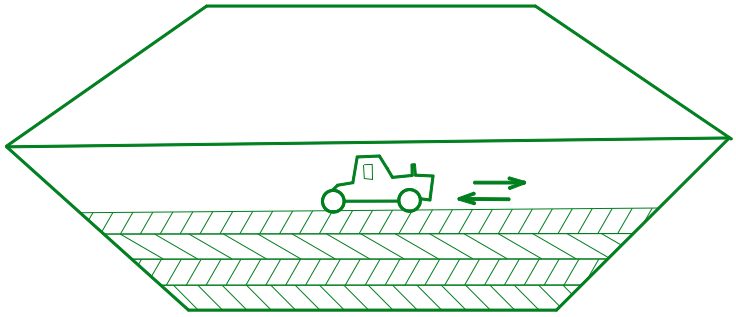

Fig. 4 – Modern waste disposal technique (fine layers).

3.3. Life Cycle of a Disposal Cell

Mechanical behaviour of a specific waste massive could be presented in two phases:

1. Operation phase: this period matches the period of examined massive building, more exactly waste disposal and the final covering layer. Waste layers are subject to constant overload. If the final height of the waste column is set by a legal provision, the amount of waste stored depends on the observed compacting during the filling. This is a variable period varying from a few weeks to a few years depending on the size of the examined cell and the flow of disposed waste.

2. Management phase: the waste massive being limited by the sealing barrier and the covering layer (provisional or definitive), the used overload for each layer of waste is considered to be constant. The compaction due to leaking and waste degradation continues. The operator is responsible for ensuring the leaking and treatment of liquid and gas effluents and control and maintenance of covering layer barriers that support the effects of compaction. In Belgium, this post-management period ends only at the discretion of the technical officer operating based on an environmental permit. Average length is 20,...,30 years.

The last phase, the post-management phase is sometimes considered at the end of post-operation. In this study, the waste is considered inert and its

features are assumed as having no effect on potential site reprofiling projects. In practice, observations are limited over periods of 10 years.

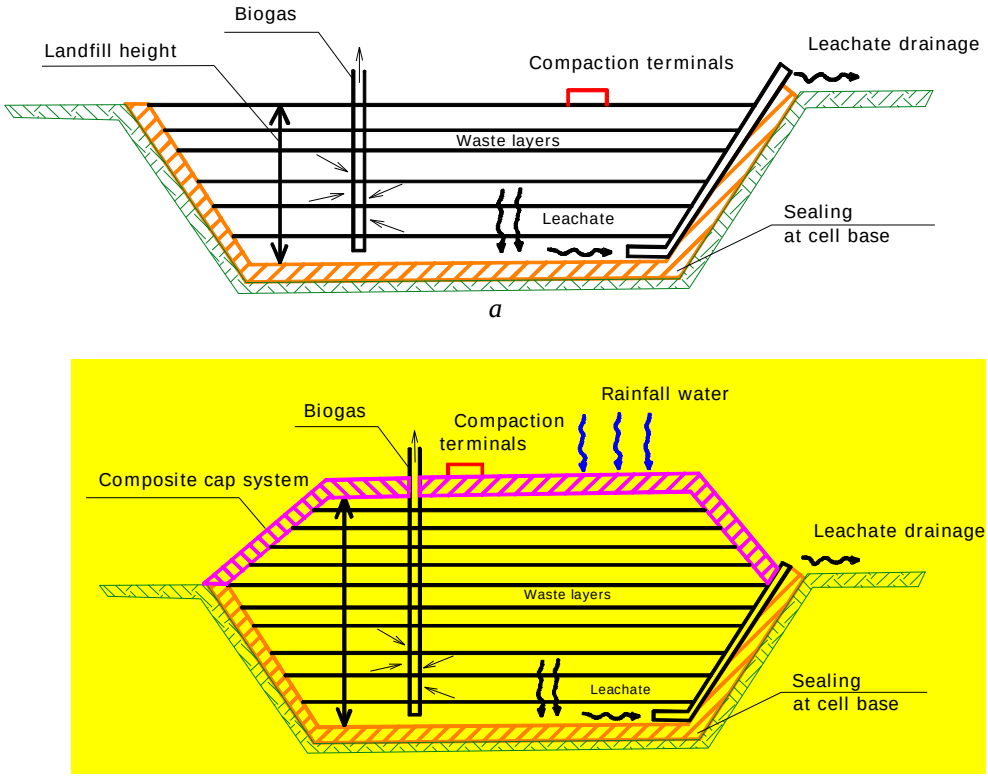

Fig. 5 – Scheme of disposal cell during (*a*) operation phase and (*b*) post-management phase.

3.4. The Role of the Composite Cap System

The composite cap system of a waste landfill plays a crucial role in the future of the site and its impact on the environment. The constitutive elements of the cap system have multiple functions: drainage of gaseous effluents, sealing, filtration, protection against interference, support of the vegetation cover, landscape reintegration, etc.

But, due to compaction, the composite cap system may undergo changes. These generate mechanical restrictions that may lead to the deterioration of the composite cap system.

As a result of this complex dynamics, the composite cap system of a landfill should be designed in such a way that it would guarantee the perenniality of its effectiveness. That is the reason why there is no single solution for the composite cap system.

Apart from the sealing features of the cover liners (semi-permeable/impermeable cover liners), the main difficulty associated with their design has led to the definition of an objective of the service life.

4. Conclusions

In accordance with the Framework Directive and Directive 1996/61/EC (IPPC), a first National Waste Management Strategy has been implemented in Romania, incorporating the sector strategies of the ministries involved. Also, since 2001, County Waste Management Plans have been implemented. On the basis of the National Strategy and the County Plans, the first National Waste Management Plan was elaborated, a national plan, which was adopted by GD 123/2003. These national waste management documents were then improved within wider workgroups, composed of representatives of central authorities, employers' and professional associations, local authority associations, representatives of universities and NGOs, as well as German experts, French, English and Japanese, involved in the twinning PHARE programs and in the JICA technical assistance program.

After the elaboration of the Strategy and the National Waste Management Plan, Regional Waste Management Plans were developed by 2007 on the basis of a Waste Regional Plans Guide.

The categories of waste are extracted from GD no. 856/2002 - M.Of. no. 659/05.09.2002 – regarding the waste management records and the approval of the list of wastes, including hazardous wastes.

Waste storage is detailed in Government Decision no. 349 of April 21, 2005, and in OM 757 of 2004.

The Directives that have been transposed into national legislation are the following: Framework Directive 75/442/EEC on waste management; Directive 1999/31/EC on the storage of waste; COUNCIL REGULATION (EEC) No. 259/93 on the supervision and control of shipments of waste within, from and to the European Community; Directive 200/76/EC on the incineration of waste; Directive 94/62/EC on the management of packaging and packaging waste**.**

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* * * HG 162/2002 privind depozitarea deşeurilor publicat în M.Of. nr. 164/7.

* * * HG 349/2005

* * * HG 856/2002

* * * Legea Mediului nr.137/1995 ; republicata in Monitorul Oficial 70/2000, Bucuresti.

* * * *Metode şi tehnologii de depozitare a deşeurilor, depozitarea deşeurilor, ministerul mediului şi gospodăririi apelor*, HG nr.1147/2002, Institutul Naţional de Cercetare Dezvoltare pentru Protecţia Mediului – ICIM Bucuresti: Pag 18 - tabel 7 – Parametrii necesari pentru urmărirea topografiei depozitului.

* * * *Normativ tehnic privind construirea, exploatarea, monitorizarea şi închiderea depozitelor de deşeuri*, HG nr.1147/2002.

* * * *Plan naţional de gestionare a deşeurilor*

* * * *Prescripţii pentru dimensionarea depozitelor controlate*, SR 13399:1996.

STUDIU COMPARATIV PRIVIND LEGISLAŢIA EUROPEANĂ ÎN DOMENIUL DEPOZITELOR DE DEŞEURI, CU REFERIRE LA ROMÂNIA, BELGIA ŞI FRANŢA

(Rezumat)

Creşterea rapidă a populaţiei, urbanizarea ţărilor dezvoltate şi creşterea industrializării generează o cantitate destul de importantă de deşeuri. Producţia de deşeuri s-a triplat faţă de cantitatea de deşeuri produsă în anii 1950.

Deşi procentul de deşeuri care se reciclează este din ce în mai mare, sunt prezente încă foarte multe depozite de deşeuri construite în anii precedenţi, care sunt actual în faza de post gestionare.

În aşteptarea unor iniţiave de redeschidere a depozitelor de deşeuri în scopul de a recupera materialele prime stocate în depozite la un moment dat, iniţiative care încep să prindă formă din ce în ce mai mult în Europa de Nord Est (şi putem menţiona proiectul european RAWFILL care doreşte stimularea diverselor autorităţi publice în luarea deciziilor în acest sens), se doreşte atât limitarea costurilor de cost gestionare a depozitelor, cât şi evitarea sau reducerea la maxim a riscurilor de alunecare a taluzelor, de poluare a mediului înconjurător, etc.

De exemplu, în ultimul inventar al depozitelor de deşeuri realizat în Regiunea Valona (Belgia) figurează aproximativ 1200 de depozite de deşeuri, dar numai zece depozite sunt actual în exploatare.

În prezenta lucrare se prezintă un studiu cu privire la depozitarea deşeurilor în țări din Uninunea Europeană. Se arată aspecte din legislație dar şi criterii constructive ale depozitelor de deşeuri din România, Belgia şi Franța.