CHAPTER

2

CHARACTERISTICS AND IMPORTANT FEATURES OF OPEN DUMPS

2.1. Introduction

Urban and industrial expansion at an ever-increasing rate, along with population increase, the rise of civilization, and the provision of ever-increasing consumption needs, result in the diminishment and depletion of raw materials, materials, fuels, and energy resources [1- 6]. On the other hand, the ecological balance has a negative impact, exacerbating the threat of environmental damage. The amount of waste produced is increasing, and traditional waste management systems are reaching their limits. Without efficient environmental management, modernization of the public alarm and warning system, the launch of an investment process for the execution of flood protection works and hazardous meteorological phenomena, and the implementation of a household waste management system and industrial, increasing environmental performance is impossible.

To achieve sustainable development, it is important to investigate the criteria and procedures to be used in environmental impact assessments. Some aspects should be taken into consideration:

► social

► economic and environmental fields: soil science, hydrology and hydrogeology, land use, and geology.

In Europe, the ratio of municipal solid waste to industrial waste is 80:20. The only distinction is the final recipient, whether public or private [7]. Due to environmental damage, waste extraction, processing, and storage, the existing flow of resources are unsustainable. For example, demand for wood and paper products continues to have a negative impact on forests, resulting in major environmental implications.

2.1. Soil and Groundwater Conditions

The landfill's main toxic compound is leachate, which is defined as a landfill containing organic or inorganic contaminants that, if not managed properly, can cause serious environmental damage.

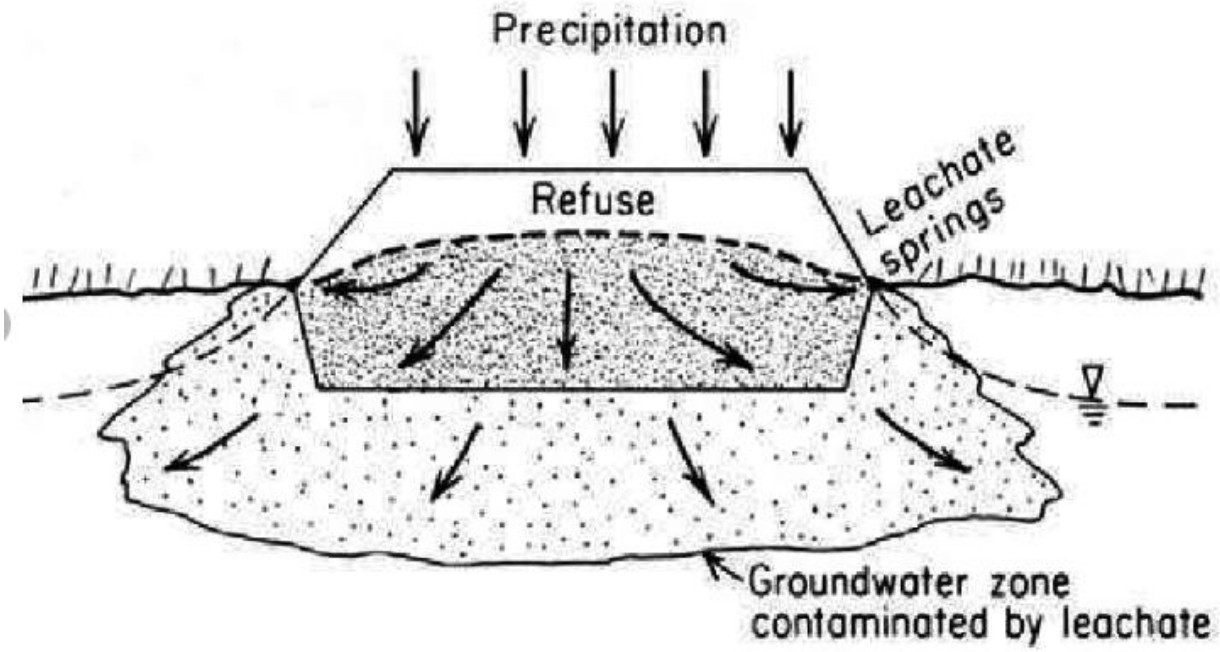
Leachate tended to migrate to surrounding soil may result in contamination of underlying soil and groundwater (Figure 2.1).

Figure 2.1. Open dumps (source:https://slidetodoc.com/chapter-18-waste-management-copyright-the-mc-grawhill/)

The term "leachate" is a scientific term for the process of removing solid municipal waste from the environment.

Leachate is defined as a liquid that has traveled through a landfill and has dissolved or absorbed environmentally damaging compounds in the material it has passed through (Figure 2.2). The leachate can then be disposed of or kept, according to scientific guidelines [8-12].

The leachate is polluted wastewater that comprises inorganic salts, heavy metals, biodegradable organic matter, and refractory compounds such as humic chemicals.



Conceptual diagram of leachate migration from a landfill and open dumps. Source: World Health Organization (2006)

Figure 2.2. Leachate migration

Leachate samples:

- stored at 4 °C and analyzed within 2 days
- collected from the old dumping area
- collected from the new dumping area- "fresh leachate"

Analysis of the physicochemical parameters: total dissolved solids (TDS), total alkalinity (TA), total hardness (TH), major cations such as calcium (Ca^{2+}) and magnesium (Mg^{2+}), major anions such as chlorides (Cl^{-}), sulfates (SO_4^{2-}), nitrates (NO_3^{-}), total organic carbon (TOC), chemical oxygen demand (COD), biochemical oxygen demand (BOD), the heavy metals such as Cd, Cu, Mn, Pb and Zn concentrations.

The following characteristics are taken into account when monitoring soil quality:

- Depth (m)
- MDD (g/cm3)
- Angle of internal friction ( )
- Cohesion (kPa)

- CBR (un-soaked) (%)
- CBR (soaked) (%)
- Permeability (cm/s)
- Specific gravity
- Coefficient of uniformity
- Coefficient of curvature
- Humidity
- Plastic limit (%)
- Diameter, mm
- Mineral composition

***Characteristics of groundwater (Figure 2.3)*:**

The following parameters are used to monitor the quality of groundwater dining:

- pH
- Turbidity (NTU)
- Total dissolved solids, TDS (mg/l)
- total alkalinity
- Total hardness (mg/l)
- Fecal Coliform (MPN/100ml)
- Total Coliform (MPN/100ml)
- Heavy metal distribution profile-Cd, Cu, Mn, Pb, and Zn
- electrical conductivity
- major cations such as Ca^{2+}, Mg^{2+}, and Fe^{2+}
- major anions such as NO_3^-, Cl^-, and SO_4^{2-}

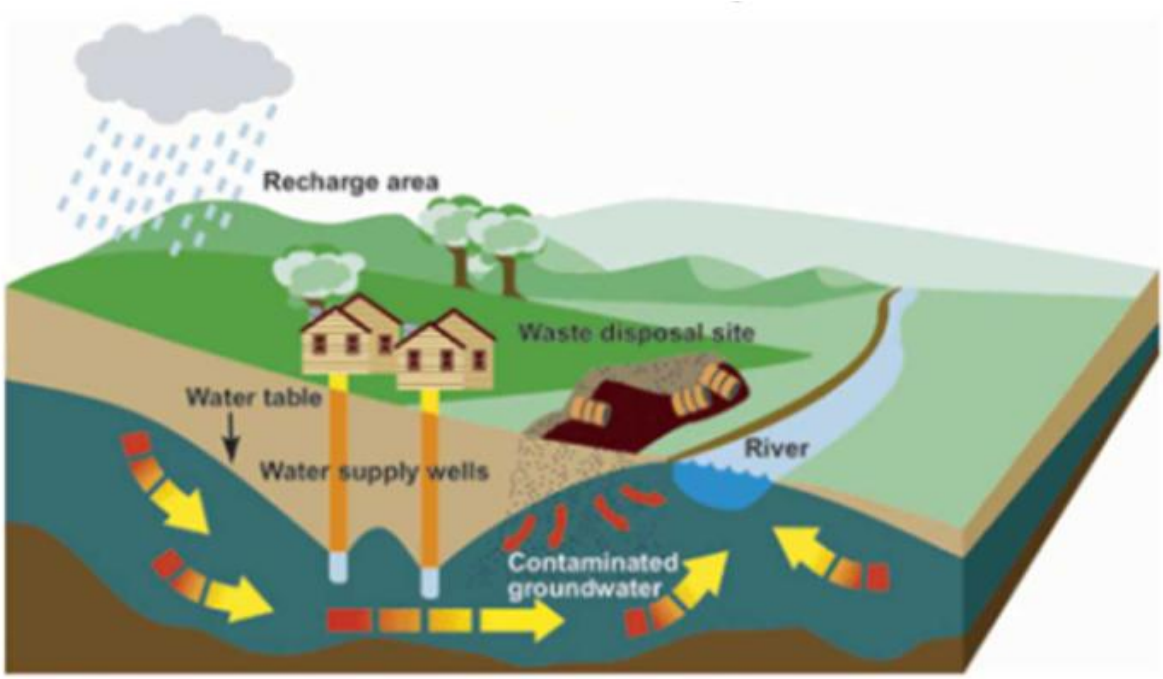


Figure 2.3. Groundwater contamination from a waste disposal site (source:https://www.hindawi.com/journals/jeph/2021/6921607/)

Geometrical Features

In literature exist many proposal options for open dumps geometrical features [13]:

- option I: inclination of the lower slope is 45°; inclination of the upper slope is 30°,
- option II: inclination of the lower slope is 30°; inclination of the upper slope is 30°,
- option III: inclination of the lower slope is 30°; inclination of the upper slope is 30° + additional buttress
- option IV: inclination of the lower slope (height 20 m) is 30°, inclination of the middle slope (height 20 m) is 25°, and inclination of the upper slope is 25°.

Waste Characteristics

The concept of waste appears in the literature under a variety of titles, including solid urban and industrial waste, household, street and industrial waste, household and street garbage, rubbish, refuse, and so on. Waste is separated into two groupings based on its destination: recoverable and irrecoverable, and waste and residues are divided into two divisions based on their origin.

Waste is classified according to its kind and location of production [8]:

- mining waste;
- waste from the metallurgical and energy industries;
- production waste;
- building rubbish;
- street waste; home waste;
- agro-zootechnical waste;
- hazardous waste;
- radioactive waste.

Because of the existence of landfills throughout Europe, the response to the waste problem is relevant (Figure 2.4).

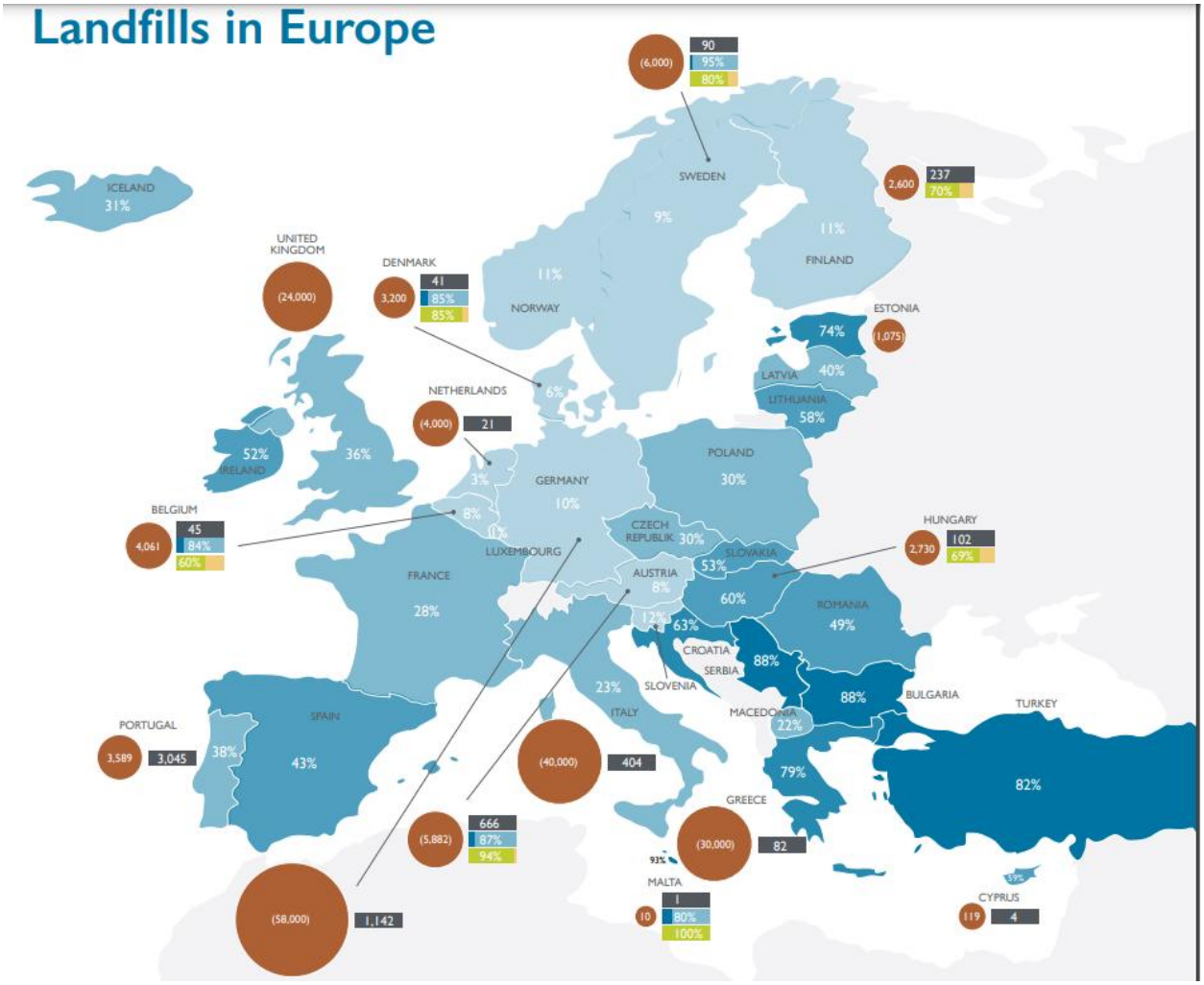


Figure 2.4. Landfills in Europe (Source: https://eurelco.org/wp-content/uploads/2018/09/landfill-situation-eu-28-)

The following aspects need to be taken into account while describing open dumps:

- The degree of contamination of groundwater, soil, and emissions from open dumps is a challenge for environmental protection.
- Waste disposal under restricted budgets is a preferred short-term option.
- Albania has the most open dumps (9046), while Denmark has the fewest (13).

The globalization phenomena can also be viewed through the lens of garbage storage: unregulated storage and buildup in poor countries.

- The number of illegal dumps reported in Europe as of 2021, by country is presented in Figure 2.5.

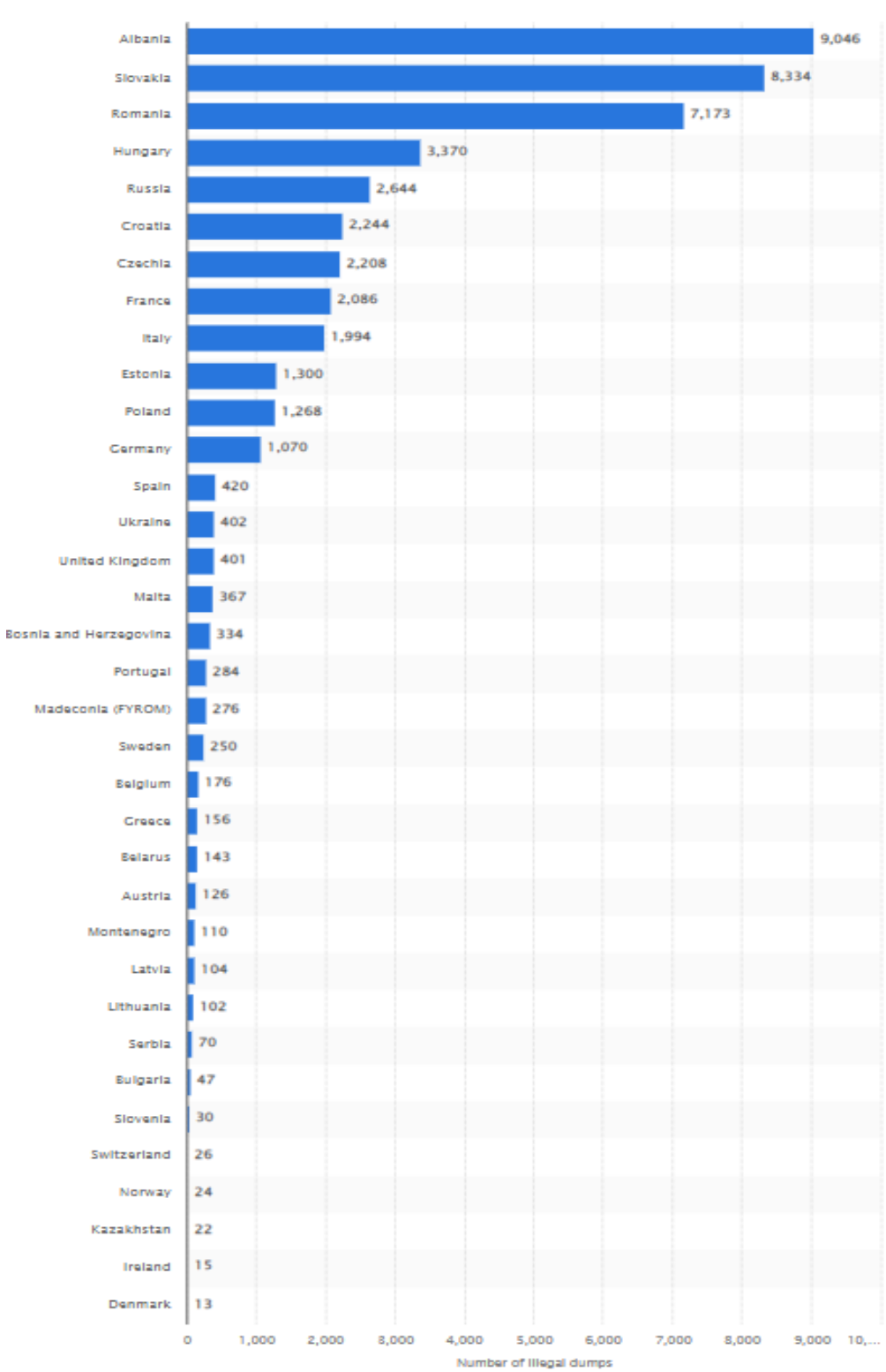


Figure 2.5. Number of illegal dumps reported in Europe as of 2021, by country (Source: https://www.statista.com/statistics/990529/estimated-number-of-illegal-dumps-in-europe/)

Household waste is collected in a diverse selection from the population; waste from trade, industry, and institutions is collected in a mixed bag and assimilated into home waste. Packaging waste generated by the general public, industry, and institutions. Municipal waste

is collected selectively from residents, businesses, and institutions. Garden and park waste, as well as waste from squares and streets, are all sources of pollution.

The analysis of the waste composition is based on the identification of the following components:

- Vegetable
- Plastic
- Paper
- Textile
- Debris
- Metal
- Glass
- pH
- Humidity
- contaminant transport model using Visual MODFLOW and MT3DMS software

The practice of dumping rubbish at open dumps creates a vicious cycle- Figure 2.6.

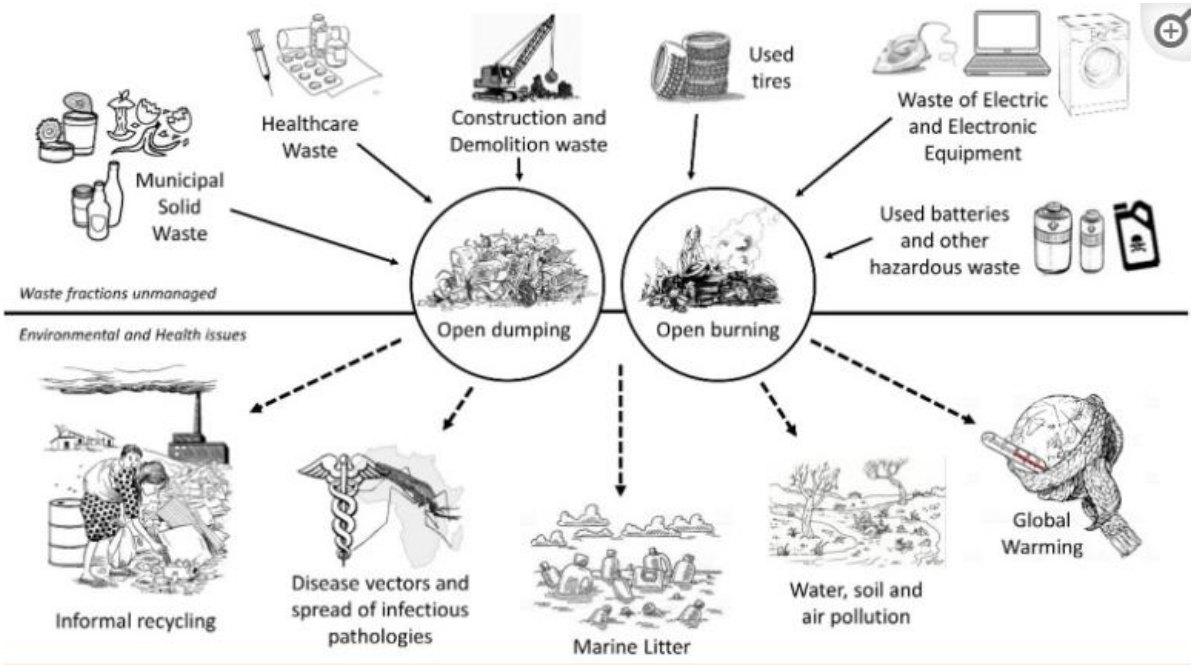


Figure 2.6. Open dumps cycle.

2.3. Environmental Issues

Waste management, which is by its very nature both a source of pollution and a source of secular raw materials, must be approached holistically, with an understanding of the long-term implications of decisions made. In this regard, contemporary waste management strategies must consider the following factors:

- reducing the amount of waste;
- avoidance of environmental pollution.

To achieve sustainable development, it is important to investigate the criteria and procedures to be used in environmental impact assessments. Some aspects should be taken into consideration:

- ► social
- ► economic and environmental fields: soil science, hydrology and hydrogeology, land use, and geology.

Evaluation methods are:

- ► distance to roads;
- ► distance to protected areas;
- ► distance to the city;
- ► distance to surface water and the soil capacity to contaminate;
- ► regional screening method

Several 7 conditional factors and 6 determining factors are chosen. The natural and usage conditions of the areas in which open dumps are located are considered: the water table depth per acre, the likelihood of landslides, the type of soils, and so on (Figure 2.7).

Figure 2.7. Surface water contamination caused by open dump
(source:https://slidetodoc.com/chapter-18-waste-management-copyright-the-mc-grawhill/)

2.4. Economical Factors

Concerns regarding final waste disposal and the concept of a sustainable society are developing over the world. There is widespread agreement on the planet's finite resources and the rising costs of waste management- Figure 2.8.

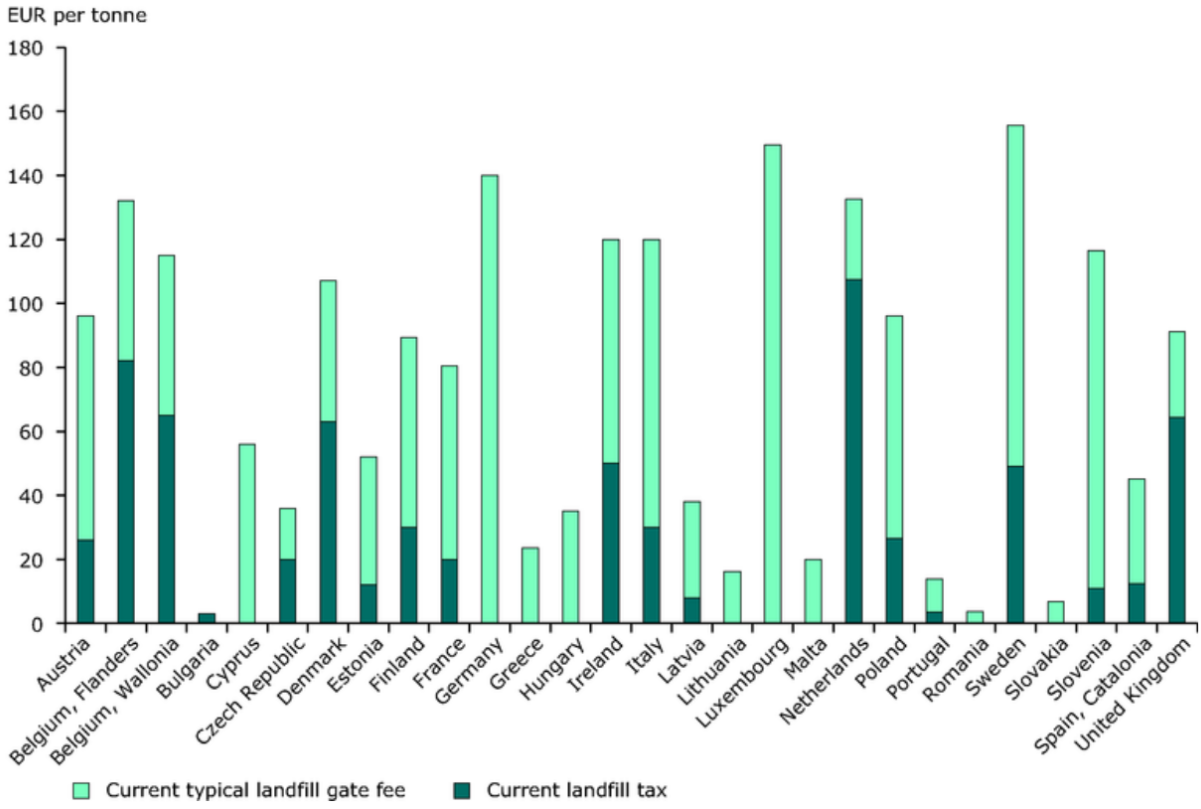


Figure 2.8. The rising costs of waste management (source: https://www.eea.europa.eu/data-and-maps/figures/typical-charge-gate-fee-and)

2.5. Decisions on Risks and Mitigation

The transformation of open dumps can be done in:

- Controlled Landfills
- Engineered Landfills
- Transform in modern landfills-stabilization of wastes
- Sustainable Landfills

Stabilized waste in this system has limited methane gas and odor production, generates less harmful leachate capable of impacting groundwater, and ensures that the landfill recovers valuable airspace paving the way for a recycle (reusable) and sustainable landfill system (Figure 2.9).

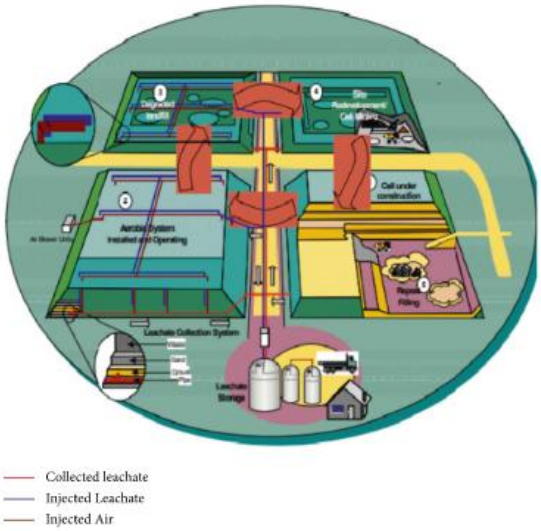


Figure 2.9. Aerobic biocell designed by the Environmental Control System, Inc., in South Carolina (2001). (souce: https://www.hindawi.com/journals/jeph/2021/6921607)

Collection and transportation of municipal solid waste are the first steps in developing treatment alternatives. Residents are usually expected to dispose of their household waste in a timely and organized way at a designated location and time within a week.

The treatment of solid waste includes collection, transportation, intermediate treatment, and final disposal, as well as resource recovery at various stages. The following are the activities that will underpin future waste management:

- ► increase the efficiency of governmental institutions;
- ► competitive forces and optimum efficiency;
- ► generating waste be separated;
- ► upgrading existing sites;
- ► siting and designing new landfills
- ► increase coverage and efficiency of solid waste services.

Implications for Human Health are as follows:

- ► toxic chemicals from an uncontrolled waste disposal site;
- ► fetal and infant mortality;

- gastrointestinal, esophageal, stomach, colon, and rectal cancers.

Completion of work to close the last open dumps is based on the following activities:

- Profiling and reconfiguration of the deposits and, respectively, covering with a layer of earth over which the entire surface will be grassed.
- Drainage works, access roads, rainwater collection systems, and other categories of works necessary to close non-compliant pits at each site will be carried out.
- The assumption of investments by mayors.
- Considering a minimum green space percentage of 30%.
- Legislative update.

Future- ZERO WASTE EUROPE consists of:

- Zero waste is the conservation of all resources using responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning, and with no discharges to land, water, or air that threaten the environment or human health*"* – Definition of Zero Waste as adopted by the Zero Waste International Alliance- (Source: https://zerowasteeurope.eu/about/about-zero-waste/)
- Zero waste does not mean we will generate less waste - it means we will keep the environment clean for future generations.
- What is very important is when the goal of waste minimization will be achieved.

Power to the people base on:

- Viable alternative solutions proposed by the social environment.
- Construction of recycling facilities next to existing open landfills.
- Encouraging the population to recover and minimize waste.
- Establishment of waste collection points near communities.

2.6. Conclusions

The goal of the open dump transformation was to explain the following aspects:

- categorization of landfills into groups specified by waste types

-constructive conditions imposed on each type of deposit thus established

-storage conditions

-requirements for monitoring environmental variables

By utilizing the SWOT analysis, these elements were approached while considering the multitude of repercussions created by the existence of a non-ecological landfill.

The summation of these consequences demonstrates the urgency of responsibly addressing the landfill issue.

The following are some of the key findings from the SWOT analysis of the open dumps waste management system:

- adoption of selective waste collection at municipal level
- Successful implementation of an underground municipal garbage collection system throughout the municipality's residential platforms.
- Sanitation services are available in every neighborhood 100% of the time;
- Differentiated waste collection pricing based on the type of collection performed;
- Economic agents' pricing adheres to the "polluter pays" idea, i.e. the quantity of waste produced.

WEAK POINTS:

- Low level of waste collection and recycling;
- There are no installations for the use/recovery/disposal of the sludge resulting from the wastewater;
- Low involvement and awareness of the population in the proper management of waste.

OPPORTUNITIES:

- expertise in implementing waste management projects
- government cooperation
- constructing a mechanical-biological treatment plant for biodegradable waste as part of the "Integrated Waste Management System";
- achieving goals and objectives; increasing public awareness and participation in environmental protection; and ensuring sanitation services that meet European standards at rates that are acceptable to the local population.

THREATS:

The lack of firm measures for the reducing vandalizing grades/positions/collecting systems the lack of projects

- vandalism of selected waste collection systems; lack of strong steps to reduce vandalism of selective waste collection systems;
- a lack of investors in environmental projects;
- rising prices of sanitation services

The current issues confronting the European Sanitation and Garbage Management System are unique to the national system and come from several factors including a lack of performance, expertise in implementing selective waste collection, and large system losses [15-19]. The removal of selectively collected rubbish from the municipal waste stream, the lack of budgetary funding, the population's low involvement, and, last but not least, the population's poor level of information and education are all contributing factors. Following primarily social and economic development on the one hand and maintaining a high standard of living on the other, the issue of proper waste management, its negative impact on the environment and human health, and the use of ineffective methods and technologies remain a problem to be solved. As a result, it is critical to implement a strategy at the local level that includes a thorough assessment of the situation, estimation of waste generation quantities and indicators, and main actions and responsibilities to reduce waste generation, increase recycling and recovery, and create optimal conditions for European waste management.

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