



Circular Economy Lab & Observatory

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# SOIL CONTAMINATION

4.b Landfills and land contamination,  
innovative ways to manage our waste

**Romania-4.1**



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## 4.b Landfills and land contamination, innovative ways to manage our waste

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What is a landfill? Why are landfills bad for the environment?

Introduction:

Any waste that cannot be recycled or reused must be disposed of, and that location is typically a landfill. Quarrying can leave a hole that can be filled with landfill sites, or landfill sites might be a part of a plan for reclaiming land.

There are landfills everywhere in the UK and the rest of the planet. Some locations engage in “landraising” (directly putting trash on the ground), while others engage in “landfilling” (filling a hole in the ground with the rubbish). These trash heaps contain a mix of commercial and residential waste.

Humans produce waste; this is an unavoidable reality of existence. Waste is a difficult problem that society must address. Over a tonne of rubbish is produced annually by a typical UK household. When you add it all up, you get a yearly total of 31 million tonnes, or the weight of 3.5 million double-decker buses, a line of which would circumnavigate the globe 2.5 times. Today, construction and commercial organizations contribute a large amount of trash to landfill sites, including soil, concrete, and brick debris.

This waste is referred to as “inert waste” because it won’t likely react with other garbage and is therefore reasonably safe for landfills. Yet the majority of business waste is inert trash like dirt, bricks, soil, and concrete.

When the site is filled, the inert waste is frequently used to construct roadways on-site.



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After the area has been covered and rendered “safe,” it is possible to repurpose it, but there are stringent limits in place.

To ensure that the rules are being followed, landfills are strategically placed, planned, operated, and monitored.

Additionally, they are made to safeguard the environment against toxins that could be found in the waste stream. Landfills are located using on-site environmental monitoring systems, and they cannot be constructed in “environmentally-sensitive” areas. These monitoring devices look for any evidence of landfill gas emissions as well as groundwater contamination.

#### Problem’s description:

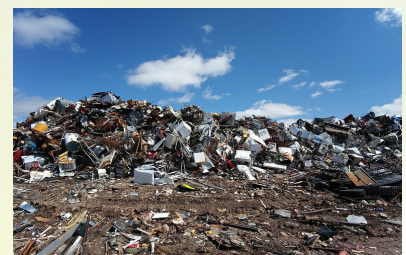
##### Environmental Impact of Landfills

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In addition to methane, landfills also release water vapor, carbon dioxide, and small amounts of oxygen, nitrogen, and other non-methane organic molecules.

If not under control, these gases can also contribute to climate change and lead to pollution. While landfills are required to have plastic or clay lining by federal regulation, these liners tend to have leaks. This can result in leachate, a liquid produced by landfill sites, contaminating nearby water sources, further damaging ecosystems.



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Ammonia concentrations in leachate can be very high. Ammonia is nitrified to form nitrate when it enters ecosystems. Eutrophication, or a shortage of oxygen as a result of enhanced plant growth, might then result from this nitrate in neighboring water sources.

Because of a shortage of oxygen, eutrophication causes “dead zones” where animals cannot survive. Leachate also contains toxic substances like mercury since hazardous items are present in landfills along with ammonia.

**Social Impact of Landfills** People who live and work close to landfills are at risk for health problems because of waste emissions. According to a New York research, there is a 12% higher chance of congenital abnormalities in babies delivered to families that resided less than one mile from a hazardous waste landfill.

Large dumps reduce the value of the nearby land by 12.9% on average. Even while smaller landfills only reduce land values by about 2.5%, they nonetheless have an influence.



Hazards from landfills include odor, smoke, noise, pests, and tainted water supplies. Landfills and hazardous waste dumps are more likely to be located in minority and low-income neighborhoods. Less money is available in these places to protest the construction of these amenities. Compared to higher income communities, they are a simpler target for landfill installation.

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#### Possible solutions:

Different types of methods are available to treat landfill leachate. These consist of:  
**Biological Treatment:** When treating landfill leachate, this is typically the initial step. In order to remove nitrogen and other biological elements from the wastewater, numerous different filters must be used.

**Chemical-Physical Techniques** – If it is possible to oxidize organic substances, wet oxidation processes can be applied. This comprises, among other things, the adsorption of activated carbon and the processes of precipitation, flocculation, and ion exchange.

The membrane used to line new landfills is specifically made to trap liquid methane and keep it from escaping into the atmosphere. Nevertheless, it is still not feasible to fully capture it. Synthetic membranes are being used in the construction of more recent landfills to stop mercury from leaking into the soil and groundwater.



Instead, the poisons are sent into a sewer system through a network of pipes, where they can be stored, burned, or turned into fertilizer. Several treatment procedures can aid in reducing methane generation, including:

- Aerobic digestion is used in open window or tunnel composting to break down organic material without releasing methane gas.
- In-vessel Composting – This aerobic process, which takes place in a closed container to aid in the breakdown of waste by microorganisms, is one method of treatment.

There are further procedures that make use of anaerobic digestion in a small area. This makes it possible to catch the methane and turn it into energy. In addition to the financial costs, burying rubbish in a landfill would cause problems for future generations because it will take a long time for it to decompose. There are various tried-and-true methods for reliably and consistently handling landfill garbage.

Landfilling continues to be the most popular alternative in the northeastern Illinois region for the disposal of solid waste, despite the numerous innovative technologies that are being developed. Due to leachate seepage and gas emissions, landfill construction and closure could endanger the quality of the air and ground water.

Public health may be at risk as a result if proper maintenance and management are not maintained for a considerable amount of time (30 years). Such management can be expensive and deadly if done incorrectly. Despite the state having modern and accessible resource reduction and recycling alternatives, the Chicago metro area still creates the most waste per capita in the nation.



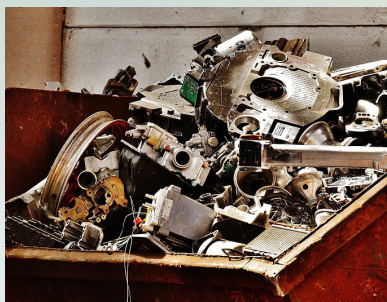
<https://pixabay.com/photos/garbage-disposal-waste-disposal-298774/>

By 2040 or before, if this tendency continues, we will experience severe consequences. To avoid future methods of trash disposal that are expensive and environmentally harmful, clear, and decisive efforts must be done now. Traditional waste management systems are ill-equipped to handle the additional trash produced by expanding populations, and the world's trash problem isn't going away any time soon.



To close the gap, local governments must adopt innovative waste management technologies that increase output, lower collection costs, and divert more trash from landfills.

Any method that makes use of technology to increase the effectiveness, affordability, and environmental friendliness of trash collection is referred to as smart waste management.



To improve waste collection and encourage future innovation, the majority of these systems are outfitted with the Internet of Things (IoT), a monitoring device that gathers and tracks real-time data. Waste Management is Being Revolutionized by Innovative Technologies like: Smart waste bins, Waste level sensors, AI recycling robots, Solar powered Trash compactors, Recycling Apps etc.

<https://pixabay.com/photos/iron-scrap-metal-thrash-metal-1504139/>

### Conclusions:

Recycling appears to be highly valued in the area, however not all communities offer curbside pickup for single and multi-family houses, particularly in the unincorporated areas. Businesses in the area typically lack a mandate or incentive to recycle, with the exception of consumer appeal, which does not compel them to engage in these activities.

The burning of unsuitable garbage and open/illegal disposal of wastes were both mentioned by the solid waste professionals in the region.

These experts believe that landfilling waste is the most cost-effective way to dispose of it, but they also concur that more recycling and resource conservation should be done to lessen the ongoing need for landfills. Recycling helps the environment be less disturbed. Animal harm is avoided when we clear fewer trees and forests. We contribute to the preservation of ecosystems and species by minimizing interruption and damage to the natural environment.



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Many of the natural resources in the world are in limited supply, thus recycling aids in their preservation. Paper recycling helps preserve forests and trees. Plastic can take hundreds of years to decompose and requires a lot of solid waste when it is recycled.

Additionally, the majority of plastic is made from hydrocarbons found in fossil fuels. Metal recycling decreases the need to mine new metal ores, while glass recycling decreases our need for some raw materials, such as sand. Utilizing recycled materials instead of new, raw resources saves energy during production.

Making things from recycled materials instead of virgin materials requires a lot less energy. One glass bottle recycled, for instance, can save enough energy to run a 100-watt light bulb for four hours. Recycling lessens the requirement for raw material harvesting.



People who live close to woods or near river systems are also displaced due to our growing demand for these basic commodities. Recycling lessens the likelihood of causing harm to someone else's property or neighborhood. Recycling uses less energy, which lowers our emissions and carbon footprint. We can lessen the amount of waste from landfills that releases methane, which contributes to climate change, by reducing our carbon footprint.

<https://pixabay.com/photos/a-book-tree-wood-forest-read-hike-5130712/>



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