

Effect of solid-waste landfilling on environment

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ABSTRACT

It is well known that in our everyday's life we have to our environment clean but through that we have to be use the waste disposal methods wisely such as incineration and landfills which are the modern method of managing solid wastes.

Disposal of municipal solid waste in landfills entails a number of environmental risks but with respect to the rapid increase in population and urbanization in industrially developing countries, the results also provided important information of landfills as a source of environmental risk. Results of this research may have an important impact on landfill management and the disposal of waste

Keywords: landfill, municipal solid waste

INTRODUCTION.

The current status of landfill problems and operation as an ultimate alternative for waste management is reviewed, including particular aspects of municipal solid waste management and their disposal in landfill. Sources of solid wastes are domestics, commercial and industrial enterprises. About 60% of domestics and industrial waste is deposited in landfills; the rest is burned, incinerated, taken to the dump or recycled.

Solid waste is a global threat both in developing and developed countries (Abarca-Guerrero et al., 2015; UNEP ,2005) however, the situation is worse in low-income countries (Nakada et al., 2006). Solid waste management practices of landfilling used by many countries have recently shifted to incineration (Lino & Ismail, 2017; Mussa & Suryabagavan, 2019; Rezaei et al., 2018) but still landfilling remain the best solid waste management practice (Balew et al., 2020; Ohri et al; 2015), and is the oldest common method of solid waste disposal

(Weldeyohanis et al., 2020). Recently, there are notable efforts worldwide towards the establishment and designing of landfills to increase environmental protection (Stamps et al., 2016; Wilson et al., 2015).

The majority of municipal solid waste is placed in landfills. In well-designed sanitary landfills are used which typically include bottom liners, leachate collection systems, leachate treatment, gas collection, gas treatment, final covers, and air and water monitoring systems. Most developing countries have protective regulations in place that prescribe the design and operation of landfills, although they are not always enforced.

Solid wastes are mainly disposed of to landfill, because this is considered to be the simplest, cheapest and most cost-effective method of disposing of waste (Barrett and Lawlor, 1995; EEA, 2003). At present, modern landfills are highly engineered facilities designed to eliminate or minimize the adverse impact of the waste on the surrounding environment, as a result of gas emissions and leachate soil percolation. The generated leachate is collected and must be appropriately treated before being discharged into the environment (Marttinen et al. 2003; Qasim and Chiang, 1994; Welandar et al., 1998)

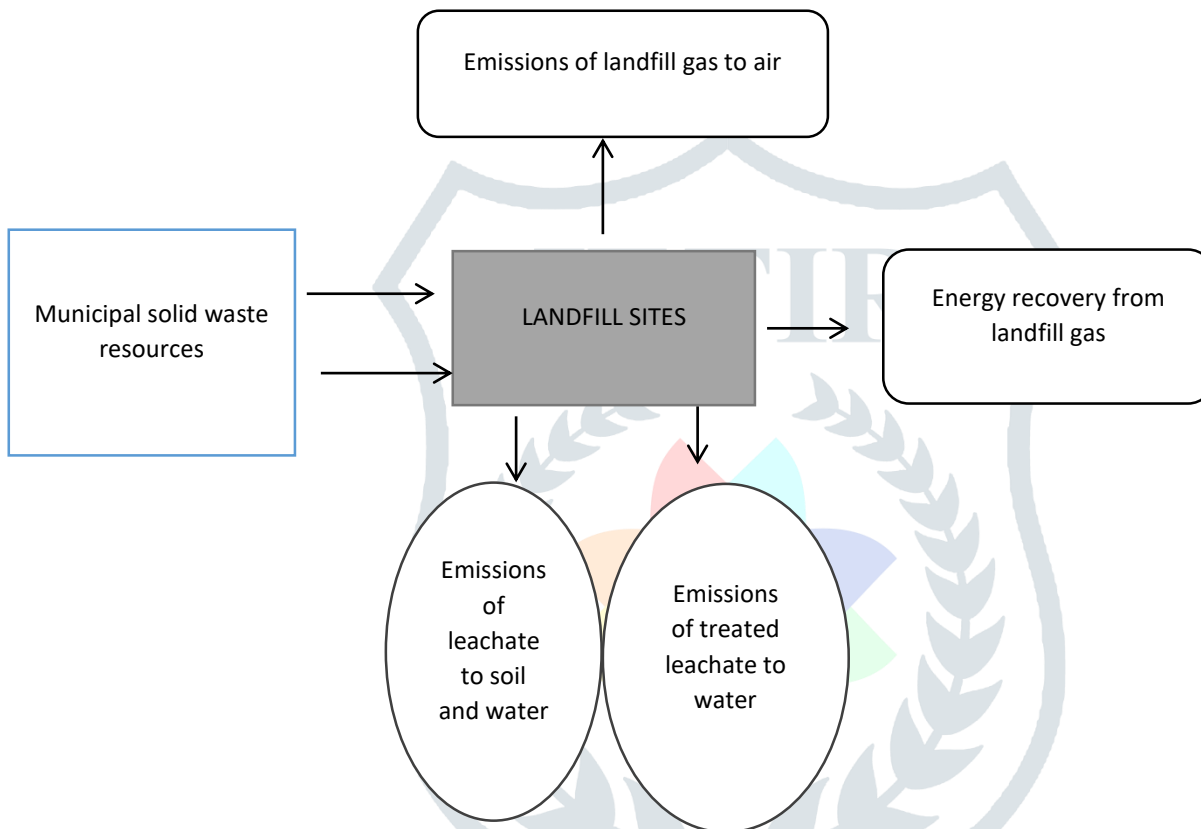
LITERATURE REVIEW

Landfill is the disposal of waste material by burying it, especially as a method of filling in and reclaiming excavated pits. There are currently three standard landfill types: municipal solid waste, industrial waste and hazardous waste. Each of the above mentioned has different practices to limit environmental impact but on my research, I will be based on Municipal solid waste landfills.

Municipal solid waste landfills, are sites that receives household wastes such as garbage's or refuse generated after use of domestic materials but also municipal solid waste also receive other types of non-hazardous wastes such as commercial waste, nonhazardous sludge, conditionally exempt small quantity generator waste.

Municipal solid waste landfills tend to have some of the strictest safety and monitoring regulations. These rules often include restrictions on location, landfill lining, operating practices, groundwater monitoring and closing practices.

From an engineering approach there is a framework showing on how the inputs and outputs system of waste management option on municipal solid waste landfills. The inputs consist of solid waste and other resources while outputs are mainly gaseous emissions, leachate which induces an important environmental impact (Pitchel, 2005)



Inputs and effects on the landfill site that causes environmental impacts (White et al., 1999)

Therefore, in the view of the mentioned above, strategies in control should involve the input (waste and water), the reactor (landfill) and the output (leachate and gases) (white et al., 1999)

Potential impact of landfill on environment

1) Natural environment

In here the landfill has impacted on cutting down trees and clearing land to extend our landfill sites where also on this method of cutting down trees we have changed the animal habitat too.

As well as the direct effects on animals, landfills are having an indirect effect on them too. Waste sent to landfill is often laden with chemicals that can affect plant growth in surrounding areas if it leaches into the ground. The chemicals contaminate plants and water which are primarily consumed by animals lower in food chains

Also, on the aspect of future generations this adds up on the impact because waste in landfill is biodegrading and while it does, it produces a landfill gas which comprises of carbon dioxide and methane. Landfills are estimated to account for 3%-19% of anthropogenic methane emissions globally. Studies have shown that future generations may deal with more frequent wildfires, droughts and tropical storms due to climate change that is brought by this harmful greenhouse gases.

2) Air pollution

As it was discussed in the above point, the study shows also about two-thirds of landfill waste contains biodegradable organic matter from households. As this material decomposes, it releases methane gas. As potent greenhouse gas, methane traps up to 20 times more heat in the atmosphere compared with carbon dioxide. Oftentimes the air surrounding landfill smells unpleasant, due to the decaying organic waste.

3) Groundwater pollution

As rain falls on landfill sites, organic and inorganic constituents dissolve, forming highly toxic chemicals leaching into groundwater, the water that mixed up with these chemicals and stays at the base of the landfill can result to serious contamination of the local groundwater. Even more dangers, this mixture usually creates a high biological oxygen demand, meaning it can quickly de-oxygenate water where could result to death of aquatic life.

4) Soil pollution

The mixture of toxic substances and decaying organic material can impact the soil quality of the areas surrounding a landfill site. This can compound the effects on biodiversity as local vegetation may cease to grow and be permanently altered.

Summary of landfills on the environment categorized in advantages and disadvantages.

advantages	disadvantages
An extensive selection of wastes are suitable for landfill	Older areas that, in some cases, are still in use or have been in use for some time, were established before the natural impact of leachate and waste gas
Provides ultimate disposal	he noticed.
Compatible and currently simultaneous or successive with all other waste management practices	Costs increase with liner, leachate collection and removal system and strict rules
Many other waste treatment and disposal options require the final disposal route for the residues to be landfill	Responsibilities for long-term and anonymous closure
Ability to derive landfill gas byproduct for industrial use, energy production	Potential long-term restrictions on land use
Possibility to implement bioreactor landfill technique in order to minimize environmental impact, while waste degradation can be optimized.	Many sites are sources of pollution with uncontrollable leaks
Infilling of the mineral workings by waste is an economical advantage for the site developer.	Landfill gas in particular can be dangerous because the largest component, methane, can reach explosive concentrations
Costs sustained incrementally while landfills expanded	Landfill gas methane is also a 'greenhouse gas', leading to global warming problems, but about 30 times
	of carbon dioxide

Generally low costs	
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Municipal solid waste landfill has two main types of pollutions which are landfill gas (LFG) and leachate but there is additional type which is toxins but those two are directly related to the quantity and quality of waste disposed as almost 65 to 80% of collected municipal solid waste is disposed into landfills in developing nations. The bulk of the waste materials disposed of (40% to 70%) are organic in nature.

● Landfill leachates

Water that infiltrates and penetrates through landfills produces leachates, which contain unwanted and noxious chemicals where it dissolves and flushes 5-7 percent of toxins with it create a foul-smelling odor which contains ammonia and various toxic salts.

Depending on rainfall, a single landfill site can easily produce several Olympic sized swimming pools of leachate each year. As leachate may absorbed or adsorbed into surrounding environment increases the amount of clay minerals or increased concentrations of carbon in soils (Williams, 2002). Moreover, the release of uncertain volumes of leachate contaminating water resources would introduce risks to public health and the adjacent environment (Christensen, et al 2001).

● Landfill Gas

Landfill gas comprises 35%-55% methane and 30%-44% carbon dioxide. Methane is produced when food, plant and organic materials decompose in the absence of oxygen. Natural gas and shale gas are both mostly methane.

As greenhouse gas, methane is 20 times more potent than carbon dioxide and its effects is only 20-23 times more potent when averaged out over 100years. Greenhouse gas production is the biggest environmental threat posed and if

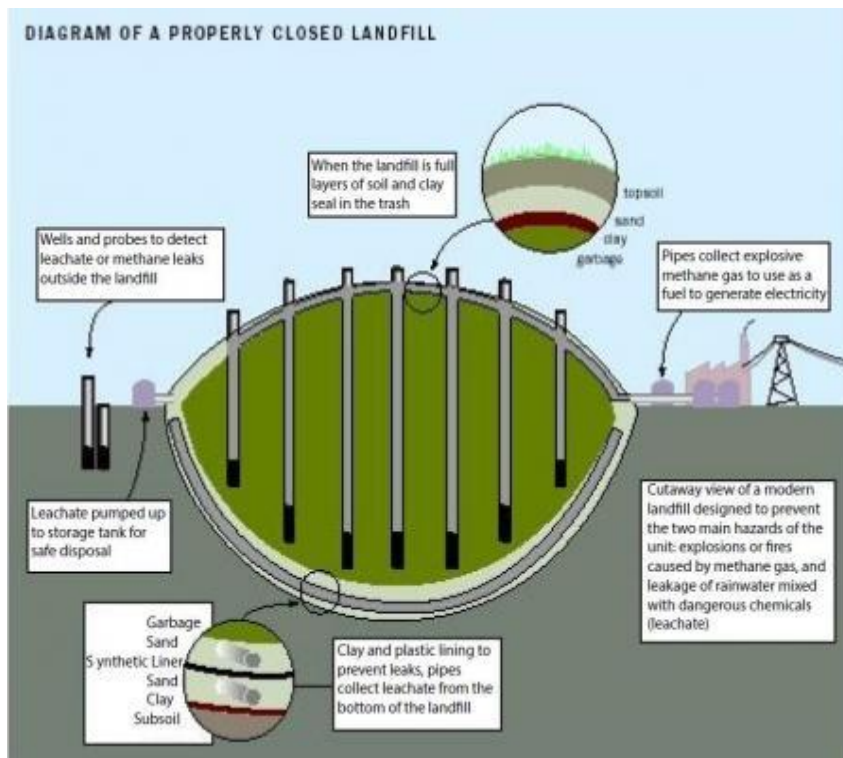
the landfill gases cannot be utilized and regenerate energy then they should be incinerated.

● **Toxins**

Landfill contains vast quantities of substances that are harmful to the environment. Plastics such as PVC leach toxic chemicals as they break down. E-wastes are fastest and growing but they are the most toxic everyday waste stream of all and most of them end up in landfill. Because E-waste is loaded with heavy metals, solvents and acids.

Each type of designated landfills can only accept particular waste for which is designated for (Williams, 2005) but as a general strategy on the revised criteria in Title 40 of the code of Federal Regulations (CFR) PART 258 addresses seven major aspects of Municipal solid waste Landfill's system, which include the following:

- **Location restrictions**—make certain that landfills are built in suitable geological areas aside from faults, wetlands, flood plains or other restricted areas.
- **Composite liners necessity**—add a flexible membrane (i.e., geo-membrane) overlaying two feet of compacted clay soil lining the bottom and sides of the landfill. They are accustomed to safeguard groundwater and the underlying soil from leachate releases.
- **Leachate collection and removal systems**—control of the composite liner and removes leachate from the landfill for treatment and disposal.
- **Operating practices**—insert compacting and covering waste frequently with several inches of soil.
These practices would help lower odor, control litter, insects, and rodents, and protect public health.



The image shows a cross-section of a municipal solid waste landfill.

- **Groundwater monitoring requirements**—insist testing groundwater wells to determine whether waste materials have escaped from the landfill.
- **Closure and post closure care requirement**—involve covering landfills and providing long-term care of closed landfills.
- **Corrective action provisions**—sway and clear landfill releases and achieves groundwater protection standards.
- **Financial assurance** - issue funding for environmental protection during and after landfill closure (i.e., closure and post-closure care).

Some materials may be banned from disposal in Municipal solid waste Landfills, including common household items like paints, cleaners/chemicals, motor oil, batteries and pesticides. Leftover portions of these products are called household hazardous waste. These products, if mishandled, can be dangerous to your health and the environment. Many Municipal solid waste Landfill have a household hazardous waste drop-off station for these materials

Conclusion

From the above study it is concluded that one of the modern method of municipal solid wastes control which is landfill has a major threat to the environment if it enforced by the state government since it can easily be transmitted from one place to place like we know leachate from refuse dumps percolates into the soil and contaminate the underground water where the contaminated water may result to cholera , gas enteric diseases to living organisms and also the water and food contamination through flies causes diarrhea in humans.

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