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Landfill Emissions and Their Impact on the Environment

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Abstract:- **A modern landfill is an engineered method for depositing waste in specially constructed and protected cells on the land surface or in excavations into the land surface. Deposits the fact that in increasing amount of waste is reused, recycled or energetically valorised, landfills still play an important role in waste management strategies. The degradation of waste in the landfill results in the production of leachate and gases. These emissions are potentials threats to human health and to the quality of the environment.**
Landfill gas consist mainly of methane and CO_2 (carbon dioxide), both important greenhouse gases. Landfill sites contribute 20% of the global anthropogenic methane emission.

Furthermore, it usually contains a large number of other gases at low concentrations, some of which are toxic. Impact of landfills include risks for public health derived from surface or groundwater contamination by leachate, the diffusion of litter into the wider environment and inadequate on-site recycling activities.

I. INTRODUCTION:

Landfilling is the simplest and normally cheapest method for disposing of waste.

The impact on water resources from landfills even in arid areas must be noticed. Even if low costs and high availability of marginal land have made landfilling the most commonly used waste disposal method. Landfilling has many effects on water resources.

Disposal of liquid waste is not uncommon in landfills in arid areas. Most arid area suffer from the sever rainfall erosion which could increase the possibility of surface and ground water contamination. Economical and cultural development has improved the standard of living and changed consumer habits in the community, resulting in a clear increase in the volume of waste.

Almost 2/3rd of landfill waste is biodegradable. This waste rots and decomposes, and produces harmful gases (CO_2 and Methane) which are both greenhouse gases and contribute to global warming.

Landfills also pollute the local environment, including the water and the soil.

According to the “Environmental Protection Agency”, “Waste-To-Energy" **incinerators** and **landfills** contribute for higher levels of greenhouse gas emissions and overall energy than following the reduce, reuse, recycle mantra.

Landfilled solid waste may or may not be sorted, may or may not include non-municipal components (industrial, construction, forestry& mining) and may or may not be disposed in an engineered or monitored setting.

Individual landfills include diverse geochemical setting with complex microbial ecosystems ranging from deeply buried anaerobic methanogenic systems to near surface aerobic systems.

All landfills evolve geochemically and microbiologically with changing environmental conditions which may be zoned or mixed, at various spatial and temporal scales, depending on the site.

Broadly, landfills are large scale landscape features consisting of millions of Mg of waste composed of both anthropogenic and natural organic matter, inorganic constituents, and buried local soils.

In highly developed countries with widespread landfilling practices such as the united states, there are stringent regulatory and monitoring requirements for the burial containment of solid waste: a “Sanitary landfill” is an engineered facility with cell construction; bottom and side liners; an under drain system to intercept liquids(leachate) for removal and treatment; engineered recovery/utilization of methane from anaerobic waste decomposition; placement of daily, intermediate and final soil cover materials, and decades of monitoring during filling and after closure as shoen in figure (1).

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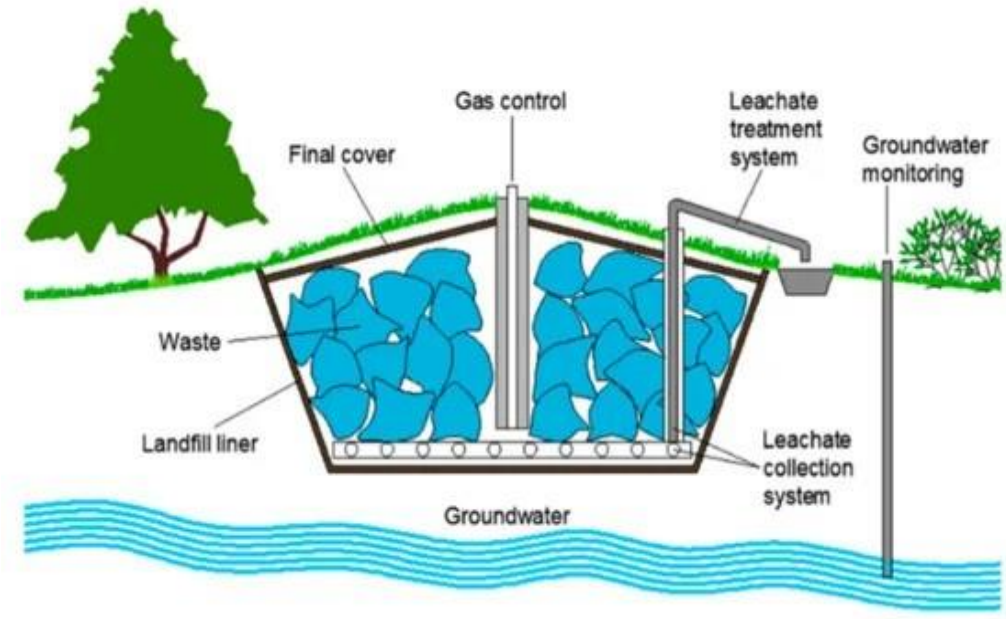

Figure. (1)

II. LANDFILL AS A POTENTIAL SOURCE OF POLLUTION:

The need for the collection and sanitary disposal of municipal solid waste (MSW) was not recognized until recently. 50 years ago, throughout the world, most MSW was disposed of in open dumps or tips.

The fundamental difference between a dump and a landfill is that in a dump there is no attempt to separate the waste from the underlying soil or rock strata and where the whole extends to below the groundwater level. Waste is dumped directly into the groundwater.

A landfill is an engineered structure consisting of bottom liners, leachate collection and removal system and final covers.

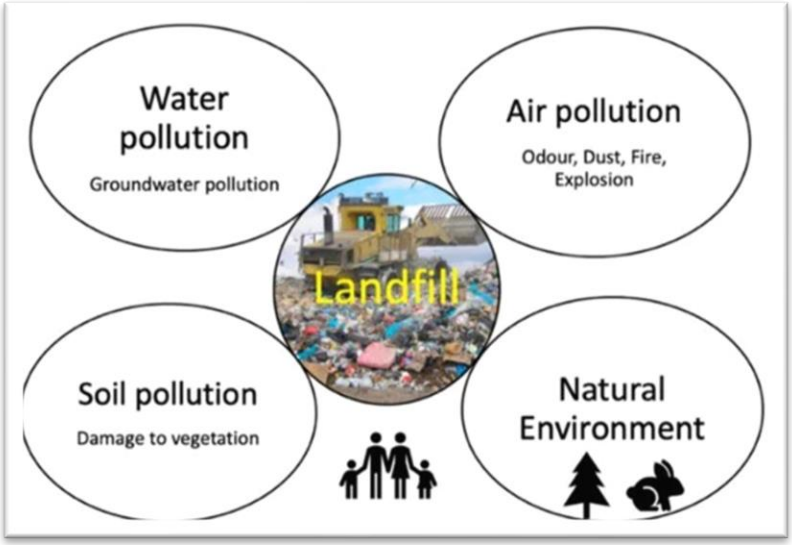

Figure. (2)

Landfills are designed both to store and to treat wastes. Much of the potential risk from MSW landfill results from the migration of contaminated leachate and landfill gas therefore the environmental impacts of the many landfills existing throughout the world cannot be ignored as we can see in figure (2).

Major emissions (leachates and biogas) are considerably affected by biological processes occurring in them if the MSW is disposed on the landfill with no pre-treatment, emissions develop during the landfill operation period, which are produced even after the landfill will have been closed.

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III. IMPACT OF LANDFILL ON ENVIRONMENT:

The migration of gas and leachate from the landfill body into the surrounding environment present a serious environmental concern, which include groundwater pollution, air pollution with impact on climate through, methane emissions and potential health hazards.

- Landfill present long-term threats to ground water and surface water that are hydrologically connected by creating a toxic soup of industrial and home cleaning chemicals.
- Almost two third of landfill waste is biodegradable this waste rots and decomposes and produces harmful gases (co_2 and methane) which are both green house gases and contribute to global warming. Landfill also pollute the local environment including the water and the soil.
- Landfill are some way that humans modify how soil form, by changing the soil forming factors of the climate, exposure and the soil organisms,
- Landfill can produce objectionable odours and landfill gas can move through soil and collect in nearby buildings. The gases produced in landfill is ammonia, sulphide, methane and carbon dioxide are of most concern.
- Ammonia and hydrogen sulphide are responsible for most of the orders at landfill.
- Unhealthy and illegal what's so bad about burning garbage, because smoke and ash pollute the air, water and food supply.
- Health is at risk for those who live within five kilometre (5km) of landfill site. Hydrogen sulphide (used as surrogate for all pollutants co-emitted from the landfills) and death caused by lung cancer, as well as death and hospitalisation for respiratory disease. When the landfill has reached its capacity , the waste is covered with clay and another plastic shield. Above that, several feet of dirt fill is topped with soil and plant which is shown in figure no. (3).

Figure. (3)

IV. ADVANTAGES OF LANDFILL:-

- Landfills are convenient to use.
- Landfill's can use the waste generated in a city, town or district and produce energy.
- Landfill can keep cities, town, and district's clean.
- Landfills are relatively safer than other waste management techniques.
- Toxic waste continues to pileup.

The most frequent threat's following out from the operation of landfill's have been described above. Now the time has come to take into account argument's advocating advantages of limited disposal of waste in landfill's.

Especially in the long-term time horizon landfilling can transform the troublesome share of waste flow into the short term gas generation and provide long term carbon supply.

However, an alternative removal of waste is currently subject of criticism by both environmentalists and landfill operations and suppliers.

Sometimes the amount of waste determined for recycling, reuse or incineration exceeds the capacity. Not all types of waste can be recycled or incinerated. For some of them landfill is the only choice and in case that the recycling facility or incinerator are out of the operation due to maintenance, repair and breakdown the waste should not remain in residential areas. This shows that some types of waste have to be disposed in landfills even when recycling and reuse are in place.

Landfill should be established by using sustainable method so that they not represent an environmental burden for future generation.

- The main advantage of sanitary landfill is that burying can produce energy and can be obtained by the conversion of landfill gas.
- The main products of landfills can be used as direct fuel for combustion or indirectly they can be processed into another fuel.

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V. DISADVANTAGES OF LANDFILLS:-

A major disadvantage of burying trash in landfill is the potential to pollute surrounding soil and groundwater with toxins.

- Landfills are literally full of waste.
- Some waste should never go there, but it does.
- Landfill effect wildlife landfills create leachate.
- Landfills affect human health.
- Landfills still emit landfill gases.
- Landfills have huge potential for groundwater pollution.
- Landfills are too easy for waste.
- Landfills are bad for our health and environment. Leak, that means that runoff from landfills, carrying with it toxic chemicals from waste ends up in our waste supplies. Many communities surrounding landfills have had there drinking water contaminated by leaking landfill.
- When organic material such as food scraps and green waste is put in landfill it is generally compacted down and covered. Eventually this releases methane, a greenhouse gas that is 25 times more patent than carbon dioxide the implications for global warming and climate change are enormous.
- Health is at risk for those who live within 5 km of a landfill site....the results showed a strong association between hydrogen sulphide and death caused by lung cancer, as well as death and hospitilizations for respiratory diseases.
- The food waste found in landfills is attracting birds, animals and rodents on our leftovers. We could in fact be giving animals that end up in our landfills food poisoning, or worse. Not only landfills are changing animal habitats, they are also destroying their natural habitats.
- The smell, traffic, noise and vermin that accompany landfills can lower house prices.

Because of the increase in vermin surrounding landfill disease become an issue with other adverse health effects, such as birth defects, cancer and respiratory illness also being linked with exposure to landfill soils.

Disposing of waste has huge environmental impacts and can cause serious problems... some waste will eventually rot, but not all, and in the process it may smell, as it generate methane gas which is explosive and contributes to the greenhouse effect. Leachate produced as waste when decomposes may cause pollution.

VI. GREENHOUSE GAS:-

When organic material such as food scraps and green waste is put in landfills it is generally compacted down and covered this removes oxygen and cause it to breakdown in an anaerobic process. Eventually this releases methane, a greenhouse gas that is 25 times more patent than carbon dioxide the implications for global warming and climate change are enormous.

Methane is also a flammable gas that can become dangerous if allowed to build up in concentration. Composting your food scraps and green waste in a compost bin eliminates many of these problems.

Apart from this financial cost, garbage buried in landfill breaks down at a very slow rate and remains a problem for future generations.

VII. WHAT SHOULD WE DO:-

- Reducing solid waste is reducing the amount of trash that goes to landfills. Reduce, reuse, recycle are most common methods to reduce landfill waste.
- Some useful steps we can take to ensure that we make fewer trips to landfill each year :

1) ***Donate clothes****;*

Donate clothes to people in need as to goodwill stores or hold a state in your garbage.

2) Reduce food waste;

Food is another item that we often just carelessly toss away without thinking twice about it. Each year a very large percentage of our purchased food is left uneaten instead of simply throwing away food, make good use out of it. Even if we keep just a small percentage of our uneaten food and donate it millions of needy people would be fed.

3) ***Save leftover for next day****;*

Too many people are careless enough to throw half of a good meal and not save it for later. Eating leftover more often will save on money and result in less food waste. Try making it a habit to save the rest of tonight's food in fridge for tomorrow's lunch or dinner.

4) ***Buy things with less packing****;*

We can also stock up on food in the freezer. Buy a bunch of food at the same time and store it in the freezer, and don't buy any more food until the freezer is empty. We should buy food in bulk means less packaging and less waste.

5) ***Boycott plastic water bottles****;*

Millions of plastic water bottles are thrown away by people every day. Don't do it, then you will not only save a boat load of money by switching to reusable glass bottles, you will be throwing a lot less water bottles into the trash. Which in turn means you won't contribute to the mountains of bottles in landfill or in the bottom of the ocean.

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6) ***Recycle****;*
Don't just throw away old glass bottles or aluminium cans, instead recycle them. Keep a recycle bin in your home to place old soda cans, paper, metal and plastic cups. Most urban areas have a recycling station in towns. Try making more trips to the recycling station then to the landfill.
7) ***Reuse****;*
Take an old shopping bag with you while going out for shopping an old shopping bag can replace hundreds of plastic bag that will end up in landfill. Use empty wine or beer bottles into lamp's, oil and vinegar dispensers or send them to recycling centres as few of them may be recycled.
8) ***Buy rechargeable batteries****;*
Rechargeable batteries will save you money in the long run and keep disposable batteries out of landfills. Disposable batteries can prove very harmful for the environment as chemicals inside the batteries can leak.
9) ***Buy items packaged in recycled carton****;*
Buy product that are packaged in recycled cartons and reuse those cartons.
Similarly, old newspaper make great packaging materials this helps to promote recycling.
10) Composting is easy and natural process that takes remains of plants and kitchen waste and turns it into nutrient rich foods which help your plants grow. Compost is organic materials that has been collected together and decomposed.
Composting helps you recycle your kitchen waste and reduces the amount of that is sent to landfills that prove safe for the environment.

- These are some useful steps, which should do for reduction of landfill waste.
- Some other solution to reduce landfill impact on environment.

i) ***Treating toxins****;*
Newer landfills are being constructed with synthetic membranes to prevent mercury from escaping into soil and groundwater.
Instead the toxins are drained through the collection of pipes and discharged into a newer system where they can be retained, incinerated or converted into fertilizer.
ii) ***Treating leachate****;*
There are range of technologies available to treat landfill leachate in different ways, these include:
A} **Biological treatment**– This is usually the first step in treating landfill leachate. It involves using many different filters to remove the nitrogen and other biological compounds from the waste water.
B} **Chemical-Physical processes**- wet oxidation processes can be used if it is possible to oxidise organic compounds. This includes activated carbon adsorption, precipitation, flocuation and iron exchange processes among them.
iii) ***Greenhouse gas****;*
New landfills are being lined with a membrane that is specially designed to catch methane in liquid form escaping into the air. However, it is still not possible to capture 100% of it. There are a number of treatment processes that can help protect methane production:-
A} **Open window or tunnel composting**- this uses aerobic digestion to decompose organic matter without creating methane gas.
B} **In-vessel composting**- This is a type of aerobic treatment that occurs in a close container to facilitate the break down of waste micro-organisms.
Other processes are available that use anaerobic digestion within a confined space. This allows the methane to be captured and converted into energy.

VIII. CONCLUSION:-

On the basis of above discussion, landfill offers a great solution for waste that can be composted and not eligible for recycling.
Landfill remains a dominant method of municipal waste management.
Landfill continues to be one of the main method of waste disposal despite there relatively high potential to pollute the environment. Therefore regular landfill maintaining is required to identify and define landfill hazards for the environment.
This research shows the necessity of identifying knowledge gaps and establishing bases for developing a more holistic framework of landfill risk analysis.
It is evident that even if high levels of waste avoidance reuse and recycling are achieved. Some waste materials are always need to be forwarded for disposal. Therefore the concept of sustainable landfill should be implemented.
A truly sustainable landfill is one in which the waste materials are safely assimilated into the surrounding environment.

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