

MITIGATION OF ENVIRONMENTAL POLLUTION BY A SANITARY LANDFILL: A REVIEW

Priyanka Pathak¹, Khushboo Kumari², Aesha Bodawala²

¹Assistant Professor, ²T. E. Students,
Civil Engineering Department, Sinhgad Academy of Engineering, Pune-48
¹priyankapathak122@gmail.com
²khushboosayshi2@gmail.com, ²aeshabodawala77@gmail.com

ABSTRACT: Management of solid wastes is a major challenge these days for the planners, administrators, engineers. Solid wastes are generated in tones and need to be collected, transported and finally disposed off. These operations should be carried out properly and also we have to make sure that it does not become too expensive or it also does not cause any harm to the environment. In developing countries, it is common to find large heaps of garbage festering all over the city. The problem gets further complicated due to large population and the obsolete techniques employed for waste management. For disposal of solid the insanitary methods has been adopted. Waste is a serious health concern. Techniques and technologies however are available and indigenous methods can be developed for managing these wastes properly. Solid wastes are simply material at the wrong place, which can be segregated, transformed, recycled and reused with great financial and environment benefits. Water enters into a landfill site from various sources e.g. rainfall, underground water, surface runoff. Water is also squeezed out of the wastes during compaction and consolidation. The leachate so formed is highly contaminated and carries many suspended and dissolved impurities in it. This report briefs about groundwater contamination due to improper dumping of solid waste and its mitigation by construction of Sanitary Landfill.

Key words: lechate, groundwater contamination, sanitary landfill.

I. INTRODUCTION

Population is increasing day by day. This is not good for environment it harms environment in various ways and now days the biggest problem is waste as with increase in population the waste produce is also increases. On regular bases humans produce waste in tones. Basically the wastes are of three types: Solid waste (e.g. food waste, rubber, sewage sludge, municipal garbage agriculture refuse etc.). Liquid waste (e.g. harmful chemicals urinary industrial liquid contaminated ground water), Gaseous waste (e.g. tail gas, lime dust, gas flaring, cigarette fumes etc.)

The waste which we produce we can't ignore it as its quantity is in billions tones. Various countries have applied various methods to deal with this problem, and most of the countries have already nailed it. Waste treatment is necessary as it shows harmful effect on environment and on human health too. Waste management is a challenge for the cities authority in developing countries like India to deal with this problem government has taken various steps like they are using various technique with help of which energy were generated from waste, they also introduce us land fill, the area where waste are dump without causing pollution.

The activities involved with the management of solid wastes from the point of generation to final disposal have been grouped into six functional elements. Those are explained below.

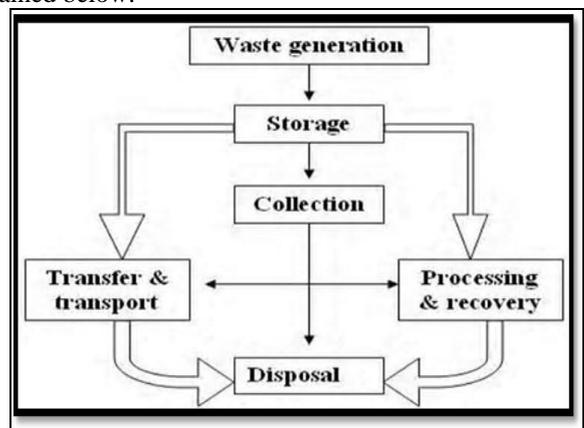


Fig. 1 MANAGEMENT OF SOLID WASTE

Waste generation: Waste is generated in tones every day. This generated waste should be processed. So for this it was sent to appropriate sites.

On site handing storage and processing: The waste which was collected is taken to the appropriate site for its treatment. On site it must be noticed that the storage should be done properly, the wastes are separated by different criteria

Collection: The separated wasters are collected at one place from where it was transported for further process.

Transfer and transport: The wastes were then transported for processing and recovery.

Processing and recovery: The waste which is collected is sent for processing and recovery. The waste is treated according to the criteria (Ferrous and, Non-Ferrous, etc.) they belong to.

Disposal: At the end, the wastes are disposed.

There are various methods of waste disposal that have been illustrated in this section:

A. Open Dump

It is an uncovered and open area where people use to through their waste without taking any preventations for environment is known as an open dump.

There are several advantages and disadvantages associated with the Open dump. Advantages: Inexpensive, skilled labors are not required, less expensive, heavy and expensive equipment are not required etc. Disadvantages: Health hazard, damage due to air population, ground water and run-off pollution

B. Ocean Dumping

This dumping involves depositing of all the waste materials from factories and industries, tankers and ships sewerage waste materials into the ocean and sea.

There are several advantages and disadvantages associated with the Ocean Dumping. Advantages: Convenient, Inexpensive, source of nutrients, shelter and breeding etc. Disadvantages: it harms the food sources , killing of plankton, desalination etc.

C. Incineration

It is process in which commercial, residential and hazardous waste were burn. Incineration converts discarded materials into bottom ash , fly ash, combustion gases, air pollutants. There are several advantages and disadvantages associated with this process .Advantages: Requires minimum land, can be operated in any weather, produces stable odor-free residues, refuse volume in reduced by half etc. Disadvantages :Expensive to build and operate, high energy requirement, requires skilled personnel, continuous maintenance , Unsightly-smell, waste vermin

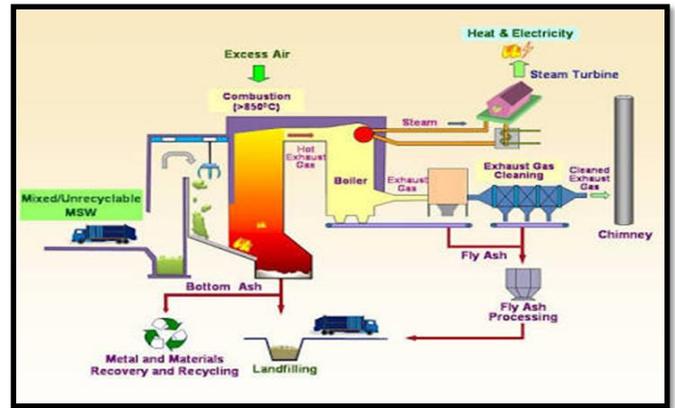


Fig. 2. PROCESS OF INCINERATION

D. Landfill

The purpose of landfill is to dispose the garbage in such a way that it will be isolated from ground, will be keep dry as it is not in direct contact with air or moisture . The main aim of this process is to keep away all the garbage from the people but does not allow it to decompose quickly. Sanitary Landfill is one of its types.

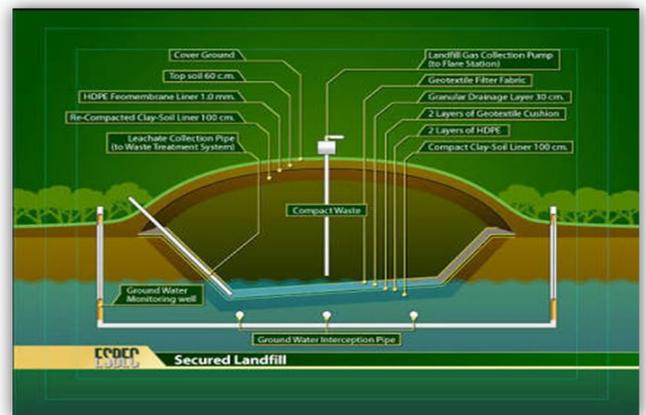


Fig. 3. SANITARY LANDFILL

SANITARY LANDFILL

Sanitary landfills are sites where the waste is isolated from the environment until it is safe. The waste is considered safe when the degradation is complete in physical, chemical and biological terms. In high-income countries, the level isolation achieved may be high but it is not necessary to spend so much money on technicalities in order to protect people from diseases. Four factors should be considered before selecting a site for a sanitary landfill.

Small incremental improvements in landfill design and operation over several years is more beneficial than making a huge increment. Large landfill require most investments to improve standards than smaller sites however, the unit cost of these improvements will decrease with increasing site size. There are financial and other benefits to site with long

operating lifetimes. Large regional sites serving two or more cities could be economically beneficial, providing waste transport costs are not too high.

A. Basic Requirements



Fig. 4. CONCEPTUAL DESIGN CROSS SECTION

- Hydrogeological isolation: If the site does not have a natural layer to prevent the leachate from penetrating into the soil then an artificial layer made of clay or plastic should be constructed. This is important to prevent the groundwater from being contaminated.
- Engineering preparation: The design of the sanitary landfill should be designed after full local geological and hydrogeological investigations are made. The design should also contain a disposal and restoration plan.
- Permanent control: Skilled staff should be employed to work at the landfill to give guidance for site preparation and construction, the depositing of waste and regular operation and maintenance.
- Planned waste emplacement and covering: The waste must be spread in different layers and the working area should be compacted and covered to avoid pest attacks.

As sanitary landfill is a good method of disposal of waste it is also having Advantages and Disadvantages too:
Advantages :Volume can be increased with little addition of people/equipment, filled land can be reused for other community purposes, no open burning, ultimate disposal, little odor, low ground water pollution, can handle large amount of wastes, release methane gas which is used as fuel etc. Disadvantages: Completed landfill area can settle and require maintenance, requires proper planning design, and operation, require skilled labors, maintenance cost is high.

II. LITERATURE REVIEW

Zanoni (1972) focused on “ground water pollution and sanitary landfill”. The principle studies concerned with

the ground water pollution potential from sanitary landfill. These studies show that leachates are highly polluting in characteristics. It also affects the ground water. To prevent ground water from leachate the landfill must be constructed 50 to 1000 feet above the ground water. This paper is concerned with the ground water pollution potential associated with the operation of dumps, sanitary landfills, and any other practices of the land disposal of solid wastes. Two often quoted conclusions from this study regarding the effects of landfills on ground water quality are:

“A sanitary landfill, if so located that no portion of it intercepts ground water, will not cause impairment of the ground water for either domestic or irrigational uses.” When a sanitary landfill comes in contact with the groundwater for a long time then all the water bodies in close proximity of the landfill get contaminated.

Christopher O.Akinbile and Mohd. S. Yousoff (2011) gave an insight on “Environmental Impact of Leachate Pollution on Groundwater Supplies in Akure, Nigeria”. The study concerned with the physical, chemical and bacteriological analysis of water sample collected from three boreholes which were located near a landfill at Akure ,Nigeria. The boreholes were located at the radial distance of 50m,80m and 100m away from the landfill respectively. The parameters which were determined include turbidity , pH temperature, dissolved Oxygen(DO), TDS, total hardness, total iron, nitrates, nitrites ,chloride ,calcium and heavy metals like copper ,lead and zinc. The study shows that pH ranges from 5.7 to 6.8 indicating toxic pollution and the value of turbidity was between 1.6 and 6.6 NTU. The statistics indicated a 95% difference in the level of pollutants. E. coli was also found in the bacterial contamination that arises from the human fecal matter. Only one borehole was severely polluted but all of them required treatments at different levels. The paper threw light on the fact that the pollution of the water bodies around the landfill depends upon the proximity of these bodies to the dump sites.

The paper further deals with the problems that are created due to the leachate formation. It further with the sorting of waste and green technologies that can be used to treat the waste. Sanitary landfill is considered as the best method to dispose off such waste. The re-designing of sanitary landfill by using clay and plastic liners so that the leachate does not penetrate this layer and gets into the water table. Along with the sanitary landfill clean technology and sustainable land management are to be adopted for the best reclamation.

Manoj P.Wagh, Piyush K.Bhandari, Swapnil Kurhade(2014) studied the “Ground Water Contamination by Lechate”. The paper focused on the disposal of solid wastes in the Asian countries where the Municipal Solid Waste’s disposal is not prioritized well due to the lack of financial resources’ and the lack of political will. The paper

is a case study of Uruli-Devachi Village, near Pune that was facing problems like flies, fire, smoke and bad odor. Also the wells were contaminated due to Lechate formation. Lechate formation occurs at the landfill's bottom due to the precipitation of the liquid waste downwards collecting chemicals and ions as it makes its way through the landfill. This Lechate then percolates through the soil and reaches the groundwater and contaminates it. If the groundwater is left untreated then diseases like anemia, kidney damage and prostate cancer can create havoc in the daily lives of the people. The environment is affected gravely and it also gives a rise to socio-economic problems.

In Uruli Devachi, where 1200 tons of waste is daily dumped at the landfill, to get rid of the odor PMC sprayed odofresh solutions. For faster decomposition they sprayed Effective Microorganism Solution that containing hundred liters of water and this was done for seven days. Due to this more Lechate was generated and hence the groundwater was contaminated to higher levels. Samples of water were taken from 5 places around the landfill ranging from inside the landfill to the well that was 1200m away from it. The results showed that the wells most near to the landfill were the most acidic in nature and were the most contaminated. Therefore during the time of site selection a landfill should be kept far away from the water supply wells. The other factors that are considered are water depth and the soil. The government has laid down the Municipal Solid Waste Rules in 2000 which need to be followed strictly. The best solution to the problem is to design a landfill in a scientific manner.

III. CONCLUSION

This paper concludes that sanitary landfill is one of the best ways to dispose of the waste that has been accumulated. It is so because it is an environmental friendly technique. It prevents the groundwater pollution and there is no essence of bad smells thus there is no scope of air Pollution. There are many benefits one of them being that

the land is not wasted. The selected site can be converted into a park and can be used for recreation. In developing countries like India Sanitary Landfill has solved the waste disposal problems as we have a lot of land that can be utilized for this without harming the environment.

REFERENCES

1. K. Knox and P.H. Jones,(1979),”complexation characteristics of sanitary landfill leachates”, water research volume 13,pp 839 to 846)
2. <https://saferenvironment.wordpress.com/2009/08/06/solid-waste-disposal-a-burning-problem-to-be-resolved-to-save-environment>
3. Parimal.P.Joshi and Amit S.Malkarnekar (KIT's college of engineering, leachate management)
4. Christopher O.Akinbile and Mohd S.Yusoff, (2011), “Environmental impact of leachate pollution on groundwater supplies in Akure,Nigeria”, *International Journal of Environmental Science and Development*, volume 2, no.1, February 2011, ISSN : 2010-0264.
5. Manoj P.Wagh, Piyush Bhandari, Swanil Kurhade, (2014), “Ground Water Contamination By Leachate”, *International Journal of Innovative Research in Science, Engineering and Technology*, ISSN: 2319-8753, Volume 3, Special issue 4, p.p. 148-152.
6. Municipal Solid Waste (Management and Handling) rules 2000
7. Supreme Court Guidelines on “solid waste management” in class I cities in India