Health Impacts of Landfills – A Case Study of Mavallipura Terraform Landfill

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Abstract- *In underdeveloped and developing cities the appropriate management of solid waste is a major problem. Landfills method / open dumping is most used for disposal of solid waste. These landfills without any engineering controls are causing water, soil and air pollution along with health effects on the people settled in surrounding areas of landfill site. In the current study, impacts of landfill site on human health are highlighted. Therefore, thisstudy was to determine the effects of the landfill on the surrounding human settlement in the Mavallipura Terraform Landfill site, Bangalore. The data was collected from household through questionnaires. The results show that open dumping of solid waste from household and the community in the landfill is causing serious health hazard and lead to the spread of infectious diseases. It was also noted that the residents whose houses are less than 3 kilometers from the dumpsite are victims of several health issues like fly's nuisance, noise pollution, dust pollution, Infections, breathing problems. Odor nuisance, skin rashes, cold, fever, headache, chest pains, diarrhea, cholera, irritation of the skin, nose & eyes. However, residents whose houses are more than 3 kilometers are also affected with the air pollution and bad smell from the dumpsite. The leachate and the control sample have been used as the samples of reference since the leachate would obviously have the highest amounts of contaminants and the control sample the least. The samples were collected in 1.5 liters sterile bottles for physical, chemical and biological analysis.Water sampling analysis & Leachate analysis is done from the samples collected from the dumping site of Mavallipura and various tests were conducted in the laboratory to know the chemical,biological & physical properties of the samples. At the same time various health survey were conducted for the residents of Mavallipura and nearby sites of Mavallipura of different age groups. With the following data obtained from the survey and samples, it is noticed that dumping of solid waste at Mavallipura landfills has resulted to be hazardous to environment and human health.*

I. INTRODUCTION

Solid wastes are termed as unwanted materials arising from human and animal activities. They also include garbage, rubbish, ashes, construction and `demolition waste, market and street refuse, dead organic waste, industrial and mining waste, sludge and agricultural waste. According to EPA regulatory definition of solid wastes includes any discarded items, things intended for use, recycle or reclamation; sludge: and hazardous waste. The regulatory definition specifically excluded radioactive waste and in-situ mining waste. Solid waste disposal creates the problem primarily in highly populated areas. The more concentrated the population, greater the problem become. Municipal solid waste accounts for major portion of solid waste produced by Indian city. The average composition of refuse by weight consists of, garbage 5 %, rubbish 1 %, ashes 15% and fine dust, silt and sand. Density of MSW ranges from 4 -6 kg/m3 and calorific value from 12 to 16 cal/kg. The density of Indian city refuse is generally higher than that of the developed countries. Indian refuse can be carried efficiently by mechanical transport by land filling. Calorific value of Indian refuse is much lower and its moisture content is high, hence it can not be burnt easily or incinerated. Solid waste is not inert, much of it breaks down over time into noxious gasses and liquids, which contaminate the air and ground water supplies around the disposal site. The principal way of dealing with solid waste is its disposal in landfills, by incineration, and through recycling. Each method poses particular hazard. The solid waste composed of varied material. Each component of which differs greatly in reactivity with oxygen, water and soil bacteria. In general the greater reactivity of solid waste, the greater will be its volume reduction over time especially in landfills. Organic wastes (agricultural waste, manure, food processing by products, household food waste, and paper yard waste) decompose and lose volume over time. This fraction of solid waste is said to be biodegradable, because biological agents break it down. Other wastes (concrete, metal, glass, whole automobile appliances) are non-biodegradable and undergo minimal break down with time. Plastics are special case, since although they Groundwater and Soil Contamination Near Mavallipura Landfill Site Among environmental problems, none has been greater historical significance than the disposal of solid waste. Today the environment is polluted, as never before because of the accumulation of solid waste. More then 9 % of solid waste in India is directly disposed on land in an unsatisfactory manner. Water and air pollution results from poor disposal practice of solid wastes. A study on Agra city shows that 7 tons of solid waste produced each day has polluted the ground

water. It is also major source of rodents and insects breeding. Solid waste causes several health problems directly or indirectly encouraging the breeding condition for flies, mosquitoes and rats which acts as the vector in the spread of at least 3 bacterial, viral and parasitic diseases.

OBJECTIVES

- To find the composition of leachate collected near base of Dumping site.
- To study the environment impact of landfill site on water and soil.
- To determine the physical and chemical characteristics of ground water collected from the Mavallipura dumpsite.
- To determine physical-chemical, macro nutrients, micro nutrients and heavy metal of soil sample near dumping site.
- To study the health impact of landfill site on people residing in the surrounding villages.
- To check the quality and the suitability of the ground water available at the dumpsite for drinking purpose.
- By using GIS, GPS and Remote sensing mapping is done.

II. LITERATUREREVIEW

Landfills are a potential threat to human health staying near to them. Landfills produce carbon-di-oxide, methane, hydrogen supplied gas, dust particles and smoke. Unlined landfill produces leachate which contaminates surface and ground water sources and spreads water borne diseases. Transport of waste to landfill sites can cause noise pollution to human beings, depending on the level and duration of exposure. Children may be more susceptible to the toxic effects of many chemicals. Increased risk of respiratory illness due to the emission of the gaseous pollutants like particulate matter (PM5 and PM1), Sulphur dioxide and oxides of nitrogen. The workers in the landfill and rag pickers are directly exposed to infectious and chronic diseases.

The landfills acts as breeding places to flies, rodents and insect, pests which are responsible for spreading of infectious and water\ borne diseases like diarrhea, dysentery, worm infection, dengue fever, cholera, (Abul Salam- 2 1 ,Alamand Ahmade-2 13

,Sankoh FPatel-2 13, MaheshwariR-2 15). Local people are exposed to methane carbon-di-oxide, nitrogen-di-oxide etc released by decomposition of organic matters in the landfill. The various gases like Sulphur dioxide, nitrogen dioxide may cause irritation of mucous membrane and deposited in the nose and upper respiratory tract which causes cough, chest tightness and breathlessness. Health problems due to odor released from leachate and landfill gases, of landfill sites may cause irritation of skin, nose and eye allergies, headache, fatigue, nausea and gastrointestinal problems (Cutler, 1986; Muiret al,.199 , Sorsa al., 1995, Dalton et. al., 1997, Aatamila, M,2 9). People living near landfill sites faces short term health effects like respiratory infections, asthma, eye and respiratory irritation, headache, stress and nausea and long-term effects like cancer, brain cancer, bladder cancer Leukemia, chronic respiratory and cardiovascular and nerves disorder.

The people living near landfills have adverse effect on spontaneous abortions, birth defects and children face the health problems like poor growly, low birth weight, prematurity and leukemi

Fig Table 2. . Municipal waste generation rate in Bangalore

Sources	Quantity Tonnes/day	Percentage
House holds	650	12.50%
Commercial establishments	1436	27.73%
Markets	369	7.12%
Hotels	1067	20.60%
Institutes	128	2.47%
Hospitals	20	0.40%
Offices	16	0.32%
Educational institutes	92	1.77%
Industries	1399	27.02%
Total	5177	100%

Fig Table 2.1. Composition of solid waste in Bangalore

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Fig.2.1. Composition of solid waste in Bangalore

Fig.2.1.1. Map of Mavallipura

III. STUDYAREA

Bangalore Mahanagara Palike proposed to setup an integrate municipal solid waste management facility in Mavallipura, 8 km from the state capital Bangalore, with a capacity to handle 6 tons/day of municipal waste generated in the urban area of west Bangalore. The present area Mavallipura dumping site is located at N13`13`56.7 Latitude and E77`14`35.8 Longitude. The proposed site situated at survey at survey No.1 8 Mavallipura yard dumping site, North-East-Bangalore,Karnataka state is used as processing of municipal solid waste generated from Bangalore city. The area of dump site is 13 Acres. The waste is transported to the site by the municipal and contract compactors. This waste is dumped in the yard in the form of heap. The rear three JCB' sin the dump yard for levelling. More than 6 compactor carousing to dump daily. At present dumping is going on and the process of converting waster in to compost is carried out in the site. The landfills is 9 years old. The people of surrounding areas are depended on bore wells for source of water. Number of bore wells in the landfills area 41% of bore wells water samples in post monsoon, 5 % are having maximum values of total dissolved solids and are exceeding WHO guidelines of 1 mg/l. Except at H1 to H5, all other sampling stations bore wells water samples total dissolved solids are beyond drinking water standards. In the old kote area, Brahman street, the borewell water is not good for drinking purposes and is unpalatable. In Sir.M.V Layout the TDS values of borewell water samples are with in drinking water standards. The high values of TDS can be attributed to the local geochemical characteristics.

Chloride: The value of chloride varies from 12 to 79 .5mg/lin pre monsoon season, 115to7773,25mg/l in monsoon season and 135 to 748.75 mg/l in post monsoon season. The variation of Chloride in different seasons. In the study area 75% of bore wells water samples in post monsoon 67% are having maximum values of chloride and are exceeding drinking water standards. All water samples in the kote area, Brahman street are not good for drinking purposes and are polluted. The chloride values of bore wells water samples of sampling station H1 to H4 within drinking water standards.

Nitrate : The nitrate values are in the range of 17 to 54.59 mg/l in pre monsoon season, 14.7 to 49.78 mg/l in monsoon season and 11.5 to 43.5 mg/L in post monsoon. The variation of nitratein different seasons. The nitrate value of bore wells water sample station H1,H9,H11 and H12 are exceeded the desirable limit of 45mg/L. In the study area 17% of sample in post monsoon season are having greater than 2 mg/l of nitrate in the monsoon season an din post monsoon season. Except stations H11 and H12 all other sampling station bore wells water samples are having nitrate concentration with in drinking water standards. All water samples in the old kote area. Brahman street and in MVL Layout are having greater than 2 mg/l value of nitrate. Nitrate concentration is more in pre monsoon. The decrease in nitrate concentration in the summer season can be attributed to the lowering of the groundwater table wherein aerobic condition is created and nitrate is partially converted to nitrogen.

Total coliforms count: The total coil forms varies from 2 to 7.25/1 ml in pre monsoon season 3.75to6.25/1 mL in the monsoon season. The variation of total coliforms counts sin different seasons. The presence of total coil is observed in all bore well samples during the season. Total coliforms are present in bore wells water samples located at a considerable distance from station systems. The presence of coil forms in bore wells water samples may be due to affiliation of leachate from the onsite sanitation compound in other seasons. The total count is more in case of M V Layout compared to old kote area, Brahman street. The high count in the monsoon season in new layouts may be due to the distance-between bore wells and casita sanitation system.. The in filtration and recharge in the monsoon season can lead to faster movement of the path hole in the groundwater compound to summer season is responsible for increasing the total coliforms count in monsoon season. The presence Escherichia-coli is not observed in any of the bore water samples during all seasons. The result of analysis of bore well water sample located-close to on site sanitation system indicates presence of high values of nitrate and chloride due to closeness of soak pits, septic tank and borewells. The nitrate tochloride ratio isgreater than one indicates the contamination of fecal origin in these groundwater sources. The study reveals nitrate contamination in most borewells water samples. The increase in nitrate concentration in the groundwater source. The preclusion of water from the sanest open unlined drainage system may also be responsible for leaching of pollution in ground water sources. Upton 3 m from the sanitation system the bore wells are contaminated with high concentrations of chloride and nitrate. The concentration of TDS and chloride is less in the monsoon season compared to other seasons. This may be to recharge amplifiers and dilution effects. Upton 3m from onsite sanitation system distance all the wells are contaminated with total count. Other sanitation systems are poorly contaminated. It is also observed that high concentrations of nitrogen are observed in both old and newly developed layer areas. More chloride and TDS is observed in are identical area compared to the new layout. The TDS concentrate ion in MV layout is exceeding the permissible limit in the old kote area at station S11 and S12. The total coliforms count is more in MV layout compared to old kote and other areas

Characteristics	L	P	G
pH	7.4	8.4	7.5
Conductivity, µS/cm	4120	2100	1362
Total dissolved solid (TDS), mg/l	2027	1447	703
Chemical oxygen demand (COD), mg/l	10,600	1080	440
Biochemical oxygen demand (BOD), mg/l	1500	105	3
Sulphate, mg/l	40	10	7
Chloride, mg/l	660	250	230
Calcium, mg/l	400	0	120
Alkalinity, mg/l	11,200	2000	600
Iron, mg/l	11.16	0.16	0.62
Copper, mg/l	0.131	BDL	BDL
Silver, mg/l	0.016	0.026	0.013
Cadmium, mg/l	0.035	BDL	BDL
Chromium, mg/l	0.021	BDL	BDL
Lead, mg/l	0.3	BDL	BDL
Zinc, mg/l	3	1	0.4
Nickel, mg/l	1.339	BDL	BDL
Sodium, mg/l	3710	1610	88
Potassium, mg/l	3675	1678	46
Nitrate, mg/l	22.36	0.18	1.08
Ammonia nitrogen, mg/l	1800	80	0.5

Parameters: Normal range for drinking water
Hardness: 0–50 ppm; pH: 6.5–8.2; Copper: < 0.5 ppm; Iron: < 0.2 ppm
Phosphate: < 0.03 ppm; Chloride: < 0.5 ppm; Ammonia: < 1 ppm; Chromium: < 0.5 ppm

Fig Table.3. Physicochemical characteristics of the leachate

IV. CONCLUSION ANDRESULT

CONCLUCION

The result of analysis of bore well water sample located close to onsite sanitation system indicates presence of high values of nitrate and chloride. To due to the closeness of soak pits, septic tanks and bore wells. The nitrate to chloride ratio is greater than one indicates the contamination of faecal origin of these ground water sources. The study reveals nitrate contamination in most of the bore well water sample. The increase in nitrate concentration in the monsoon season indicates leaching of nitrogen ground water source. The percolation of water from stagnant open unlined drainage system may also be responsible for leaching of pollutants into the ground water source. Up to 3 m from one sanitation system the bore wells are contaminated with high concentration chloride and nitrate. The concentration of TDS and chloride is less in monsoon season compared to other seasons. This may be to recharge of aquifers and dilution effects. Up to 3 m from onsite sanitation system distance all bore wells are contaminated with total count. One sanitation system is poorly constructed which provides pathways for movement of contamination. It is also observed that high concentration of nitrate observed that high concentrate ion of nitrogen observed in both old and newly developed layer areas. More chloride and TDS is observed in the residential areas compared to new layouts. The TDS concentration in Sir. M. V. Layout is low and is with permissible limit. TDS concentration is exceeding the permissible limit in old area at station S11and S12.

RESULT

- Below table shows the results, the characteristics of
- the leachate from Mavallipura landfill.
- As for metals, high concentrations of iron in the leachate, followed by zinc, nickel were observed
- The concentrations of chromium, copper, cadmium, and lead were low.
- The leachate and the control sample have been used as the samples of reference since the leachate would obviously have the highest amounts of contaminants and the control sample telecast.
- The control sample in this case was taken from a ground water source that is a tunnel elevation from the waste dumpsite and all the other samples (4) are at lower terrain from the dump.

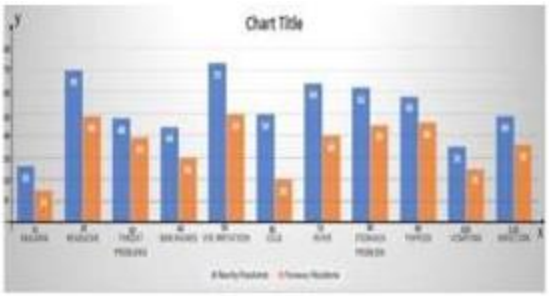

Fig.4.2. Disease % Graph

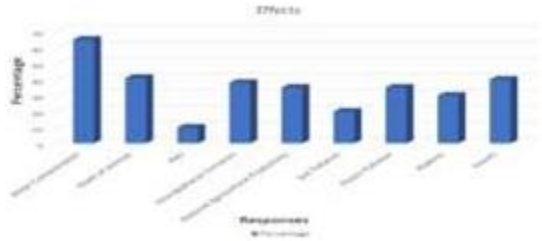

Fig.4.2.1. Effects % Graph

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