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INCIDENCE OF DISEASES AMONG RESIDENTS LIVING NEAR THE MUNICIPAL LANDFILL SITE IN ALIGARH CITY

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Abstract

This paper seeks to examine incidence of diseases among residents living near the Municipal landfill site at Pala Sahibabad in Aligarh City. The study is mainly based on the primary sources of data collected through field surveys with the help of questionnaire interviews put to 320 residents living within 300m around this landfill site. The study showed that residents reported occurrence of diseases such as conjunctivitis, malaria, hookworm infections, amoebiasis, typhoid, diarrhea, cholera, jaundice etc. during the last two years. There was higher incidence of diseases among residents living closer to the landfill site as compared to those living farther away.

Introduction

Modernization and progress have had their share of disadvantages and one of the main aspects of concern is the pollution it is causing on the earth – be it land, air and water. With the increase of population and rising demand for food and other essentials, there has been rise in the amount of waste being generated daily by each household. The per capita waste generated in urban areas of India having a population of less than 1 million is about 0.21 kg per day, while in areas having a population of more than 5 million it goes up to 0.50 kg per day (NEERI, 2000). In eighties the family waste used to be 7 kg but now it is more than 50 kg (Ahmad, and Jamwal, 2000). The household waste is ultimately thrown into the waste collection centres from where it is collected by the municipality to be further thrown into the

landfills and dumps. However, either due to resource crunch or inefficient infrastructure, not all the waste gets collected and transported to the final landfill or dumpsites. If at this stage, management and disposal is not properly done, it can cause serious health hazards and problems to the surrounding areas.

Indian cities have a striking similarity in terms of heaps of garbage and overflowing and poorly maintained landfill sites. The term landfill is used for any controlled or uncontrolled disposal of waste to the land (Vrijheid, 2000). A dumping ground or a landfill site is generally, a low - lying and marshy area, which is located on the outskirts of a city, where there is, usually, no human population. The increase in the city population, which has forced people to settle near and around the dumping grounds, has led to the

problems of people living in unhealthy conditions and protesting for the closure of the landfill site as it causes health problems for the people in the vicinity. The average life of the landfill site is 30 years but in India the average life of a huge landfill site is only 5 to 6 years and thereafter the municipality faces great difficulty in finding an alternative landfill site. The waste, which provides some money after selling (like paper, glass, metal etc.) is sold by rag pickers to the informal waste dealers. But the other non - organic wastes (like old batteries, thermocol, polythene bags, debris etc) which do not have such incentives are dumped. These are dumped in low lying areas and take long time to decompose. The organic waste undergoes natural decomposition and generates a fluid known as leachate, which is very harmful to the ecosystem if not treated properly. The leachate penetrates into the soil (if not prevented) and pollutes the ground water. Also, flies, cockroaches, mosquitoes and many other pests breed on the waste and unless properly maintained, the landfill sites are a public health hazard.

Keeping all these aspects in mind, an attempt has been made in this paper to examine the incidence of diseases among residents living near a Municipal landfill site located at Pala Sahibabad in Aligarh city (27°53' N latitudes and 78°4' E longitudes). Aligarh is a medium sized city located in the western part of Uttar Pradesh in the fertile Gangetic Plain about 130 km away from the national capital New Delhi (Fig. 1).

Database and Methodology

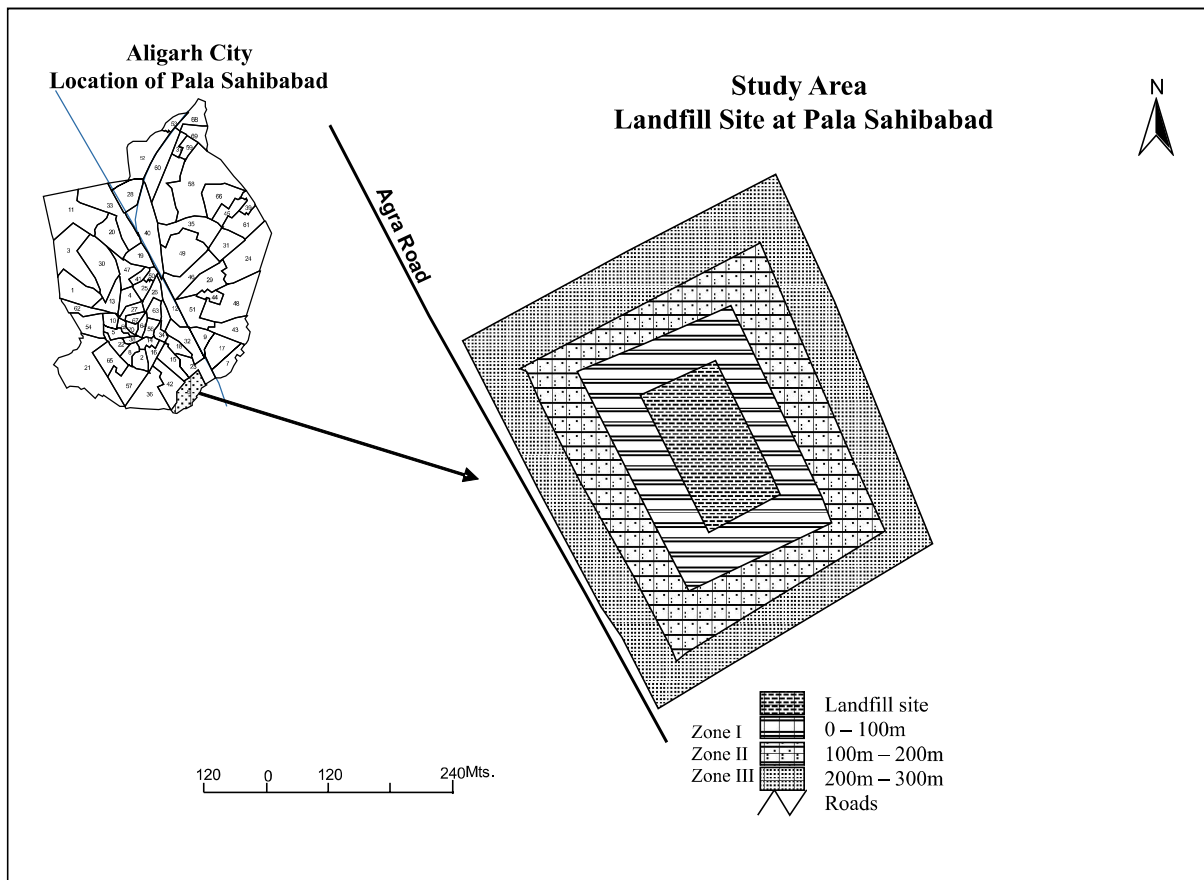
The study is primarily based on primary sources of data which were collected with the help of questionnaire and interviews from the residents living within 300 m from the landfill site. The survey was conducted during the year 2009 - 2010. The following methodology has

been employed:

1. For locating and mapping the municipal landfill site at Pala Sahibabad in Aligarh city, Google image and Arc View 3.2 version was used (Fig. 2).
2. To examine the health conditions of the residents living near the landfill site, three zones of 100m each (I, II and III) were demarcated around the landfill site. Residents of the households located around the landfill site upto a distance of 300m were sampled (Fig. 1).
3. For in-depth investigation, 20 per cent of the residents from the three zones were sampled (Zone I – 140 residents, II – 100 residents and III – 80 residents). The total sample size consisted of 320 residents living around the landfill site upto a distance of 300m.
4. A questionnaire was prepared with the help of questionnaires used in similar studies (Singh, A.L. et al., 1996, Rahman, 1998, Srivastava, 1999, Sanyal, 1998, Siddiqui, 2003, Khan, 2005, Salahuddin, 2010) to collect information about the health conditions of the 320 residents.

Discussion and Results

The population of Aligarh city has increased from 480,520 in 1991 to 669,087 in 2001 and is likely to be 912,388 by 2011 and 1,249,352 by 2021. So, it is for certain that with high growth rate of population the amount of waste generation will obviously increase because it is directly linked with size of the population, degree of urbanization and industrialization, changing life styles, food habits and culture of over consumerism which gave rise to throw away pattern of waste. The city generates about 400 metric tones / day of solid waste and is likely to generate 507 mt./day by 2011 and 694 mt/day by 2021 (Census of India, 2001). For example, a rich family will



Source: Google Image, Jan. 31, 2009 and field survey, 2009-10.

Fig. 1

generate nearly 4 to 5 kg of mixed waste per day; a middle class family will generate between 1 to 3 kg of mixed waste per day and a poor family will generate nearly 500 grams per day (Salahuddin, 2010). The amount of waste is increasing both in kind and quantity and its collection is reaching beyond the carrying capacity of any landfill site.

Residential, commercial and industrial areas, hospitals, hotels/restaurants, slaughter houses, street sweeping, sanitary drains, debris from construction and demolition sites are the main sources of municipal solid waste. The city generates about 194 mt/day of biological waste, 96 mt/day of recyclable waste, 64 mt/day of landfill waste and 46 mt/day of hazardous waste (RCUES, 2008). The main source of

municipal waste is residential area which contributes about 47 per cent of the total waste generated from household which includes leftover food, vegetable and fruits waste, gardening waste, plastic packets, milk sachets and pouches, rubber, rags, jute, paper, wooden and glass material, broken crockery etc. The waste like paper, plastic, metals, ceramics, ash, cardboard and constructional debris is generated by industrial and commercial areas. The output of waste depends upon economic and educational status, dietary habits, life styles, living standards etc of the people. Many Indian cities produce more organic waste (kitchen waste) and lesser recyclable waste (paper, metal and plastic). In general the organic content of domestic waste is about 70 to

90 per cent, while inorganic content like tins, cans and paper is about 20 to 30 per cent of the total refuse produced.

The Aligarh Municipal Corporation manages the city waste i.e. it is responsible for collection, transportation and final disposal of solid waste within the municipal area. Collection is the first process and it involves primary collection (door to door collection and street sweeping) and secondary collection from waste dump sites (mostly located on main roads). Solid waste is then transported by trucks, tippers, dumpers, JCB, mechanical loaders to the final landfill site. Only 70 per cent of the total waste gets collected and reaches the final disposal site. Presently the city waste is being disposed of in the low lying areas/ditches located along the Kuwarsi bypass in Chilkaura village and along the G.T. road (going towards Kanpur) in Tajpur Rasulpur village. In addition to these two disposal sites in the fringe villages, solid waste is also being disposed in different parts of the city. Previously the authorized disposal sites were at Bhujpura and Iglas road but due to growth of settlement around these sites, the dumping site has been shifted to Pala Sahibabad (Dainik Jagran, 9th Jan. and 23rd April, 2010).

Municipal Landfill Site at Pala Sahibabad

The area under investigation is the only authorized municipal disposal site of Aligarh City. It is located about 7.5 km away from the city centre in Pala Sahibabad, a fringe ward (no. 6) on Pala Road, a branch of Agra Road which is one of the important roads connecting Aligarh to Agra city (Fig.1). This landfill site is located in a densely populated ward having a population of 10,349 persons. This ward has 1,592 households, mainly dominated by Hindus belonging to the very low (< Rs. 2,000 per month), low (Rs. 2,000 to 10,000 per month) and medium (Rs. 10,000 to 18,000 per

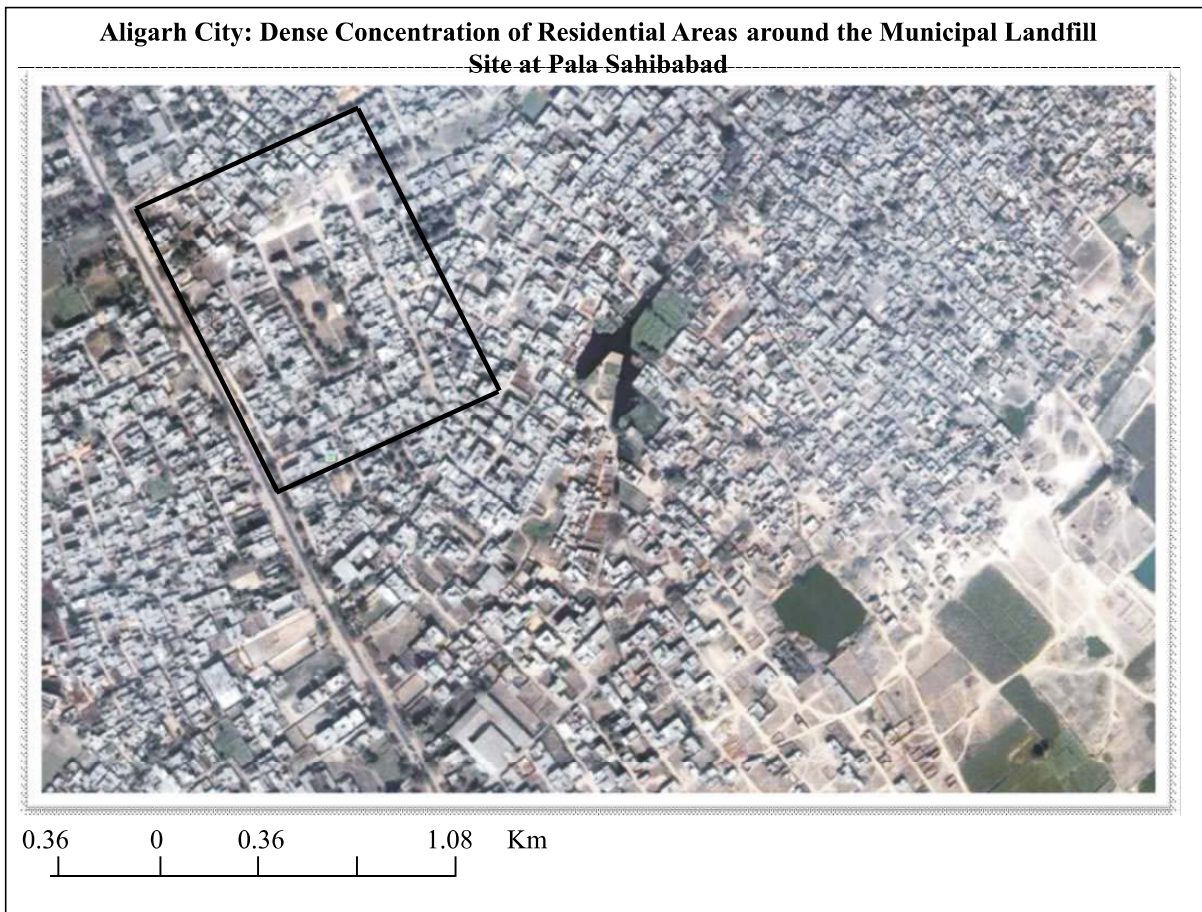
month) income groups.

The Pala Sahibabad waste disposal site is presently an open dump site, where waste is being dumped in an unorganized manner in a 7.5 acre open land. Previously, this land has been the buffer zone for the nearby brick manufacturing unit. The site is approached by a *kutchra* road which passes through the residential areas. The waste coming to the landfill site is spilled over along the road and is dumped in a haphazard manner all around the dump site. Previously this landfill site was located on the outskirts of Aligarh city where there was no population or any residential concentration but now with the increase of city's population, people are forced to settle near and around the landfill site having unhealthy conditions. Google Image (Fig. 2) shows that this landfill site is surrounded by dense residential areas. Congestion of houses could be observed around the landfill site.

'Garbage – garbage everywhere not a place to walk'- this punch line perfectly describes the present scenario around the Pala Sahibabad landfill site. Garbage mounds rotting in the landfill site, choked overflowing drains creating waterlogging conditions, pungent smells and dust, the disease vectors and pests (rats/mice, mosquitoes, houseflies, cockroaches etc.) attracted by the garbage – trigger an overall unhygienic dirty conditions for the residents living nearby.

The group at risk from the municipal landfill site at Pala Sahibabad where unscientific disposal of solid waste is carried on includes the residents living close to the waste dump. For collecting information 320 residents living within the range of 300m from the landfill site were sampled and the information gathered is presented in Tables 1 and 2.

Table 1 is showing the zone-wise percentage distribution of sampled residents living around the Pala Sahibabad landfill site



Source: Google Image, Jan, 31, 2009.

Fig. 2

according to their educational, occupational and income status. The table reveals that about 57 to 83 per cent of the residents were educated but their level of education was very low. Most of them were educated only upto primary level (Zone I - 75 per cent, Zone II - 70 per cent and Zone III - 67 per cent). About 69 to 79 per cent reported to be employed mostly in the lower economic sectors such as labourers, mechanics, petty business dealers and in other services. Most of the labourers and mechanics lived in Zone I due to their low level of education. The residents / households living around the landfill site were mostly from very low to low (Zone I - 60 per cent, Zone II - 75 per cent and Zone III - 82 per cent) and medium income group (Zone I - 40 per cent, Zone II - 25 per cent and Zone III - 18 per cent).

Table 2 shows the zone-wise percentage distribution of sampled residents living around the Pala Sahibabad landfill site according to sanitation, waterlogging and garbage collection facilities. About 93 per cent of residents in Zone I, 85 per cent in Zone II and 56 per cent in Zone III reported of having flush type of latrine facility inside the premises. Very few were having manual latrines. While, about 44 per cent in Zone III, 15 per cent in Zone II and 7 per cent residents in Zone I reported of going toilet outside the premises. Most of them defecated in the open (along the roads, railway lines, open fields etc) and few preferred using public toilets because of long queues and unhygienic conditions in the latrines. The excreta from flush latrines was either disposed of in the septic tanks or in municipal sewers or in open

Table 1
Aligarh City: Zone - wise and Socio – economic condition –wise Distribution of
Sampled Residents Living Around Pala Sahibabad Landfill Site.

Sl. No.	Socio-economic Conditions of the Sampled Residents	Education, Employment and Income status	Percentage of Residents			
			Zone I (upto 100m)	Zone II (100 to 200m)	Zone III (200 to 300m)	
1.	Educational Status	Uneducated	42.86	17.00	18.75	
		Educated	57.14	83.00	81.25	
	• Levels of Education	Primary	75.00	70.00	67.00	
		Secondary	15.00	10.00	15.00	
		Undergraduate	8.00	10.00	8.00	
	Graduate	2.00	10.00	10.00		
2.	Employment Status	Unemployed	21.43	25.00	31.25	
		Employed	78.57	75.00	68.75	
	• Type of Employment	Labourers	37.36	6.00	20.64	
		Mechanics	25.73	20.67	18.18	
		Petty Business	9.09	46.67	36.36	
		Doctors/Engineers	0.55	5.33	3.64	
	Other Services	27.27	21.33	21.18		
3.	Income Status	< 2,000	24.29	40.00	56.25	
		• Rupees Per Month	2,000 – 10,000	35.71	35.00	26.25
		>10,000	40.00	25.00	17.50	

Source: Based on field survey, 2009 - 2010

Table 2
Aligarh City: Zone-wise and Sanitary condition – wise Percentage Distribution of
Sampled Residents Living Around the Pala Sahibabad Landfill Site.

Sl. No.	Sanitary Conditions	Sanitation Facility	Percentage of Residents		
			Zone I (up to 100m)	Zone II (100 to 200m)	Zone III (200 to 300m)
1.	Latrine facility	Inside the premises	92.86	85.00	56.25
		Outside the premises	7.14	15.00	43.75
	• Type of latrine facility inside the premises	Flush	100.00	94.12	77.78
		Manual	0.00	5.88	22.22
	Disposal of excreta from flush latrine	Septic tanks	76.92	81.25	14.29
		Open drains	0.00	0.00	22.86
Municipal sewers		23.08	18.75	62.86	
Disposal of excreta from manual latrine	Open drains	0.00	40.00	40.00	
	Open fields	0.00	60.00	20.00	
	Municipal waste bin	0.00	0.00	40.00	
• Type of latrine facility outside the premises	Open defecation	70.00	60.00	60.86	
	Public latrines	30.00	40.00	39.14	
2.	Waterlogging	Yes	30.86	31.00	42.50
		No	69.14	69.00	57.50
• Place of waterlogging	Around the house	12.00	33.33	38.24	
	On the roads	88.00	66.67	61.76	
3.	Mode of disposal of household/industrial/commercial waste	Collection point	62.14	40.00	35.00
		Road side	20.57	28.00	40.00
		Open fields	17.29	32.00	25.00
	• Frequency of garbage collection	Daily	37.86	35.00	23.75
Twice a week		62.14	65.00	76.25	

Source: Based on field survey, 2009-10

drains. While from manual latrines excreta was disposed either in open drains or in open fields or in municipal waste bins. This causes health hazards because it attracts flies, cockroaches, mosquitoes, worms etc. Residents reported waterlogging problems mostly around the houses and along the roads in all the zones. These became the breeding grounds for mosquitoes. Although Pala Sahibabad is the authorized disposal site but the residents living around reported that they were also disposing their household waste in collection points, along roadside and in open fields (which is hardly left due to dense settlement and this can be seen from the imagery (Fig. 2). The garbage was reported to be collected by the municipality but the frequency of collection is very poor in all three zones i.e. mostly twice a week. This low frequency of collection leads to accumulation of waste which is a health hazard because it attracts flies, rodents, insects, animals etc. which help in spreading diseases.

Incidence of Diseases Among Residents Living Near the Municipal Landfill Site

Household surveys helped in collecting information regarding the frequently occurring diseases during the last two years as reported by the residents living within 300m of the Pala Sahibabad landfill site. The eight frequently occurring diseases reported by the residents were conjunctivitis (40.65 per cent), malaria (37.46 per cent), hookworm infections (31.10 per cent), amoebiasis (30.14 per cent), typhoid (27.15 per cent), diarrhoea (20.51 per cent), cholera (13.44 per cent) and jaundice (8.65 per cent) (Table 3). The nearby private doctors also reported that these diseases were also common in the neighbourhood of the landfill site.

Conjunctivitis is most common cause of red irritated eye. It is associated with poor quality of life. The disease thrives in poverty, ignorance, poor personal hygiene and illiteracy. It favours eye to eye transmission. Eye seeking flies help in spreading the disease by physical

Table 3
Aligarh City: Zone-wise and disease – wise, Percentage
Distribution of Sampled
Residents Living Around the Pala Sahibabad Landfill Site.

Sl. No.	Reported Diseases	Percentage of Residents			Total Average (Percentage)
		Zone I (upto 100m)	Zone II (100 to 200m)	Zone III (200 to 300m)	
1.	Conjunctivitis	45.71	40.00	36.25	40.65
2.	Malaria	42.14	39.00	31.25	37.46
3.	Hookworms	33.57	31.00	28.75	31.10
4.	Amoebiasis	36.43	29.00	25.00	30.14
5.	Typhoid fever	30.71	27.00	23.75	27.15
6.	Diarrhoea	24.29	21.00	16.25	20.51
7.	Cholera	18.57	13.00	8.75	13.44
8.	Jaundice	10.71	9.00	6.25	8.65
	Average	30.27	26.13	22.03	26.13

Source: Based on field survey, 2009-10

transmission. Of the total sampled residents 40.65 per cent reported of its occurrence (Zone I- 46 per cent, II- 40 per cent and III – 36 per cent) Malaria is a prolonged disease caused by infestation with parasites transmitted to man by infected female *Anophele* mosquito. Stagnant water in open blocked drains and *waterlogging* provides ideal breeding ground for mosquitoes. Of the total sampled residents 37.46 per cent reported the occurrence of malaria (Zone I- 42 per cent, II- 39 per cent and III – 31 per cent). Hookworm infection is caused by *ancylostoma duodenal*. These enter the human body usually by faecal penetration in the skin. It may also enter by oral route by direct ingestion of infective larva via contaminated vegetables and fruits. Of the total sampled residents 31.10 per cent reported its occurrence (Zone I- 34 per cent, II- 31 per cent and III – 29 per cent) (Table 3). Amoebiasis is a common infection of human gastro - intestinal tract. It is transported by faecal/oral route and through use of contaminated water. Cockroaches and rodents carry cysts and contaminate food and drink. Of the total sample 30.14 per cent reported of its occurrence (Zone I- 36 per cent, II- 29 per cent and III – 25 per cent). Children are especially affected by diarrhoeal diseases which are exclusively transmitted by faecal oral route. Of the total sampled residents 21 per cent reported of its occurrence (Zone I- 24 per cent, II- 21 per cent and III – 16 per cent). The main cause for the spread of typhoid fever, cholera and jaundice is faecal and urine carriers, contaminated water, food and flies. Of the total sampled residents 27 per cent reported occurrence of typhoid fever (zone I- 31 per cent, II- 27 per cent and III – 24 per cent), 13 per cent reported of cholera (zone I- 19 per cent, II- 13 per cent and III – 9 per cent) and 9 per cent reported of jaundice (zone I- 11 per cent, II- 9 per cent and III – 6 per cent).

A perusal of Table 3 shows that the

households nearer to the landfill site reported higher incidence of diseases (average of 8 diseases zone I- 30.27 per cent, II – 26.13 per cent and III – 22.03 per cent). Self reported symptoms were significantly higher in the residents nearby. Explanations include a casual link between the landfill and adverse health outcomes. As one moves away from landfill site the incidence of diseases decreases, although the per cent variation is very small. This proves that living near the landfill site is very dangerous from health point of view. Although this is an authorized municipal disposal site where much care should have been taken by the municipal authorities, but the poor condition reflects the callous attitude of the municipality.

Domestic waste which forms the bulk of city waste poses a serious threat, as it ferments, creating favourable conditions for the survival and growth of microbial pathogens. Direct handling of solid waste can also result in varied types of infections and chronic diseases amongst the waste workers and the rag pickers being the most vulnerable. Other high-risk group includes residents living close to a land fill site and those, whose water supply has become contaminated either due to waste dumping or leakage from landfill sites. The residents around the landfill were surrounded by waste dumps. These dumps pose direct or indirect threat to human life by providing the breeding sites for houseflies, cockroaches, rodents, mosquitoes and other pests causing waste related diseases. The socio-economic conditions of the residents (educational, occupational and income status) play an important role in determining the health of residents. During the survey, it was observed that the uneducated, unemployed having low incomes were found to be at a higher risk and are most vulnerable to diseases associated with solid waste.

Apart from the reported diarrhoeal diseases, jaundice, typhoid fever, hookworm infection, amoebiasis, cholera, conjunctivitis and malaria, an increase in health outcomes such as headache, sleepiness, respiratory symptoms, psychological conditions, gastrointestinal complaints, adverse pregnancy outcomes, renal diseases have also been reported in various studies (Vrijheid, 2000). Few studies have also investigated the health impacts of non hazardous wastes. It revealed that psychological, digestive tract, respiratory and allergic complaints have been associated with waste site. Vomiting, nausea and loss of appetite were also shown to be associated with landfill and odors (Zeida, et. al., 2000).

Observations

The foregoing analysis reveals that:

- The landfill sites are the most vulnerable areas of the city and the people living around or close to it are at great risk from various types of diseases.
- Dumping of large quantities of mixed solid waste collected from different areas of the city (residential, commercial, industrial, hospitals etc) in landfill sites surrounded by residential areas has increasingly caused concern because accumulated waste becomes a health hazard. It decomposes and favours fly breeding, attracts rodents and vermins. The pathogens present in the solid waste are transferred back to man's food through flies, cockroaches etc. It also leads to water and air pollution.
- Dumped solid waste increases the risk of adverse health impacts. It encourages the occurrence of conjunctivitis, malaria, diarrhoeal diseases, hookworm infections, amoebiasis, typhoid, cholera, jaundice etc. Health problems such as headaches, sleeplessness, respiratory symptoms etc.

were consistently reported by the respondents during the health surveys.

Suggestions

Since the disposal site at Pala Sahibabad is now surrounded by residential areas and it is risky for people living around it therefore, the researchers on the basis of field survey would like to propose other landfill sites such as near Bauner village along G.T road; near Talaspur Kalang Village along Ramghat road; Sikandarpur along Anupsahar road; Lekhrapur along G.T road; Bajidpur along Khair road; Digsy along Gonda road and Palaeseya along Iglas road for waste disposal. From these, two or three sites can be selected for the development waste dumping sites. These sites have been suggested keeping in mind the municipal solid waste rule 2000, that 'the landfill site should be away from habitation centre.' The city requires good governance. However, a clean city is not an accident but it is the result of a concerted effort on the part of the citizens, the city managers and the society as a whole.

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