

## **Environmental Aspects of Solid Waste Management: A Case Study of Narayanganj City**

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### **Abstract**

*Improper management of solid waste is one of the main causes of environmental pollution and degradation in many cities. Many cities lack solid waste regulations and proper disposal facilities. The present paper attempts to say that the poor disposal and handling of waste leads to environmental degradation, damage of the ecosystem and poses great risks to public health in Narayanganj city. The study shows that there is a significant link between the improper management of urban solid wastes and the environmental pollution. In order to achieve the goals and to assess the environmental aspects around the ultimate disposal sites of solid wastes the current amount of wastes, generation and the nature of solid waste management system of the city has been analyzed. Finally the paper suggests that some measures and steps should be taken to keep the city nice and healthy.*

**Key Words:** *disposal, environmental degradation, leachate, recycling, solid waste management*

### **Introduction**

Environmental degradation due to unplanned waste disposal and improper waste management in urban areas was not the prime concern even a few decades ago in the developing countries like Bangladesh (Bhuiyan *et al.*, 2003). But the increasing urban population made the environmentalists think about the scientific waste management with topmost priority in urban planning in the developing countries. It has only been in the very recent times, when certain NGOs started working and highlighting the pathetic state of municipal waste services provision in the country. Then the decision-makers began to realize the importance of this particular aspect of environmental management (Rahman *et al.*, 2000) . The study make an attempt to assess the existing solid waste management system of Narayanganj city and the environmental aspects associated with the current practice of final disposal of solid wastes. The study reveals that the uncollected wastes are dumped in open spaces and streets which clog the drainage system creating serious environmental degradation and health risks in the city.

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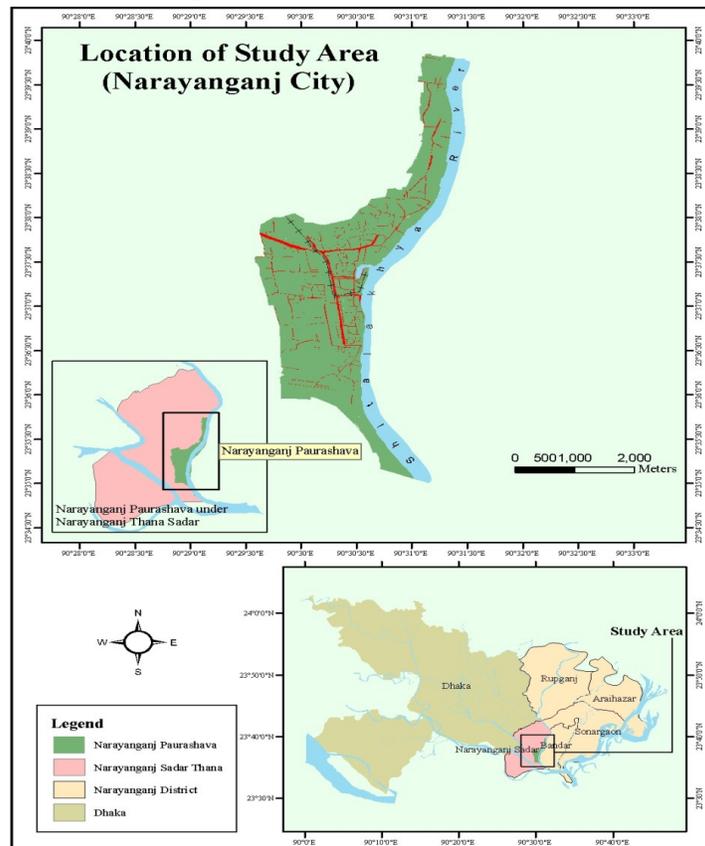
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## Study Area

Narayanganj city, located some 17 km southeast of Bangladesh capital Dhaka, on the flat Ganges Delta and alluvial plain, is one of the oldest municipalities in Bangladesh. The Shitalakshya divides the city into two parts, the Narayanganj Municipal Area (Western part) and Kadam Rasul Municipal Area (Eastern part). It is situated on the west bank of the river Shitalakshya, at the confluence of the Shitalakshya and the Buriganga. From time immemorial, Narayanganj city has been acting as a center of business and industry, especially in respect of the jute trade and processing plants, and the textile sector of the country. In addition, Narayanganj and Dhaka together make up the principal industrial region of Bangladesh. The Narayanganj Pourashava has 2,41,393 inhabitants living in 50638 households (Narayanganj Pourashava, 2009). This huge number of population creates a very large amount of solid wastes in the city that may be responsible for the environmental pollution of the city. As such, Narayanganj city is selected purposely as the study area of this research.

**Map-1: Location of the study area.**



Source: Asib and Quader 2009

In Narayanganj of Bangladesh, like in other developing countries, the materials discarded are usually regarded as a municipal liability. This includes household garbage and rubbish, commercial refuse cleaning and maintenance refuse of dead animals, basin and drain cleaning wastes, bulky wastes and sanitation residues. Household garbage and rubbish are also known as residential refuse or domestic wastes. This includes food preparation, sweeping, cleaning, fuel burning and gardening wastes. Commercial refuses are the wastes of the category that come from stores, offices, fuel service stations, restaurants, warehouse and hotels. The wastes usually comprise packing and container materials, used office supplies and food wastes. Institutional refuse of wastes of schools, offices, hospitals, police barracks and religious buildings (Byron, 1956). This category usually produces large portion of paper. Street sweeping is the source of wastes that comprises dirt and litter, household refuse, drain clearings, human fecal. In Narayanganj city sewerage is not the major means of containing human excreta and sludge, sanitation residues may occur from privies and latrines. The night soil- generated in these sanitation systems awaits regular cleaning that may get service either from the municipality or from the private sector. Processing and non-processing industries as well as utilities produce industrial wastes in the city. This include packaging material, food wastes, spoiled metal, plastic and textiles, fuel burning residuals and spent processing chemicals.

### **Objectives of the Study**

The aims of the present study are:

- i. to illustrate the types and current amount of wastes generation in the city,
- ii. to portray the types of solid waste management system of the study area and;
- iii. to assess the environmental aspects around the dumping sites of solid wastes of the city and to suggest for taking necessary measures on the basis of the findings.

### **Methodology of the Research**

The methods used for this study are a combination of observation by transect walk in the study area, case studies and questionnaire survey. The study was conducted from May 2009 to December 2009. The data were collected in and around different dumping sites of the study area along with other sources of waste generation. Observation was done by transect walk in the study area to observe the sources of wastes, types of wastes and dumping sites of wastes and necessary notes were taken in the notebook. Photographs were taken during the observation. 10 waste collectors from different organizations including Municipality, CBOs and NGOs, and 10 inhabitants living adjacent to the dumping sites were selected for case studies. Other relevant data for this research were collected directly from the field by using a questionnaire which contained structured and open-ended questions. The sample size was 120 households for the questionnaire survey. The key part of the questionnaire inquires the perception on the environmental aspects of the dumping sites and their adjustment process with that environment. They included all types of households regardless of profession, nature of work, academic attainment, social status, political attitude, land ownership, gender perspective and other components to get a respective opinion.

The methodology adopted for the present study also makes extensive use of secondary material and laboratory analysis to build up and support the objectives of the study and to corroborate the findings that give an account of current amount of wastes generated by the inhabitants of the city and collection and efficiencies of pourashava authority. Through reviewing available literature, observations and conducting case studies the locations for data collections through questionnaires were selected purposively.

### **Current Amount of Wastes Generation**

Narayanganj city is predominantly an industrial area. A huge quantity of industrial waste such as, polyethylene, cloth and papers is generated here daily. Narayanganj Pourashava authority is the only formal organization responsible for waste management, estimated to generate around 120 to 125 tons everyday (Narayanganj Pourashava, 2009) out of which about 50 percent is disposed of in the landfills and the rest left unattended and locally dumped. It is broadly estimated that between 8 -10 percent of the total municipal budget is used for solid waste management which is approximately 0.75 million taka per year (Narayanganj Pourashava Authority, 2009). Around 367 municipal cleaners are working in street sweeping and waste collection activities. In Pourashava area the per capita rate of waste generation is 0.5 kg/d and the amount of residential waste is half of the total amount. The major components of municipal solid wastes include food, vegetables, fruits, polyethylene, paper and cloths. Among these, food and vegetables wastes comprise the major component of the city waste both in the residential and the commercial areas. A rough estimate of pourashava authority suggests that around 58.9 tons of waste generate from residential source which covers 52.12 percent of total wastes of 113.02 tons per day (Narayanganj Pourashava, 2009). Sources from commercial and industrial areas respectively generate 24.74 and 20.62 tons of wastes daily which are the nearly same in amount (Narayanganj Pourashava Authority, 2009).

### **Solid Waste Management System of Narayanganj City**

Solid Waste Management of Narayanganj Pourashava consists of the following four phases:

#### **i. Primary Collection and Accumulation**

Usually the households bring their refuse to the nearby communal bins/containers located on the street side, while in some specific areas there is a system of house to house collection of garbage with the initiative and efforts of the community. These collected wastes are deposited in the bins on some convenient spots of the streets. The household, commercial, institutional and medical wastes are deposited in the same waste collection bins located on the streets. Street sweeping is done manually and debris are loaded from the kerb-side into the handcarts and delivered into the collection bins. Sweepers/cleaners sweep roads and clean drains and then put those wastes into the nearby dustbins or containers using a Hand Cart. Presently some Community Based Organizations (CBOs) do the house-to-house collection of Solid Wastes at a reasonable charge, which is, accepted by the city dwellers. The CBOs cover about 30 per cent of the total area which is residential and every household pays 25 taka per month for this. Since 2005, these CBOs are playing significant role in primary collection of Solid Wastes. The CBOs are managed by the managerial bodied selected/ elected by the inhabitants of the communities. It is notable here that

CBOs have no coordination with the municipal authority in the study area. The wastes collected by Community Based Organizations (CBOs) are deposited in five specified dumping sites of the city that are located at Panchabati, Khanpur, Chashara, Kalir Bazar and Shahid Nagar. However, still most of the domestic, commercial and Industrial solid wastes are being accumulated into the dustbins/containers by the concerned households/owners themselves.

## ii. Transportation

Wastes are transported by fleet (a flat bedded van like vehicle) from the old part of the city where the roads and the lanes are narrow. Every vehicle has got specified areas and route through which they move to collect wastes. The vehicles engaged in waste collection are operated mainly early in the morning of the day from the different sources to the bins on the streets and from the bins to the dumping sites by the trucks. The following table shows the statistics of transporting vehicles for carrying solid wastes of the city.

**Table-1: The statistics of transporting vehicles.**

Vehicles	Nos.	Capacity per Vehicle
Garbage Truck	7	1.5- 3 ton
Rickshaw Van	21	100 kg
Trolley	30	25 kg

Source: Narayanganj Pourashava, 2009.



**Photo-1: Dumping of Solid Wastes.**

The photo shows that the day laborers who are engaged in dumping are at higher risks of infectious diseases because of lacking of proper training and awareness initiatives by the responsible municipal authority. It is noted here that currently out of 7 garbage trucks two are out of order.

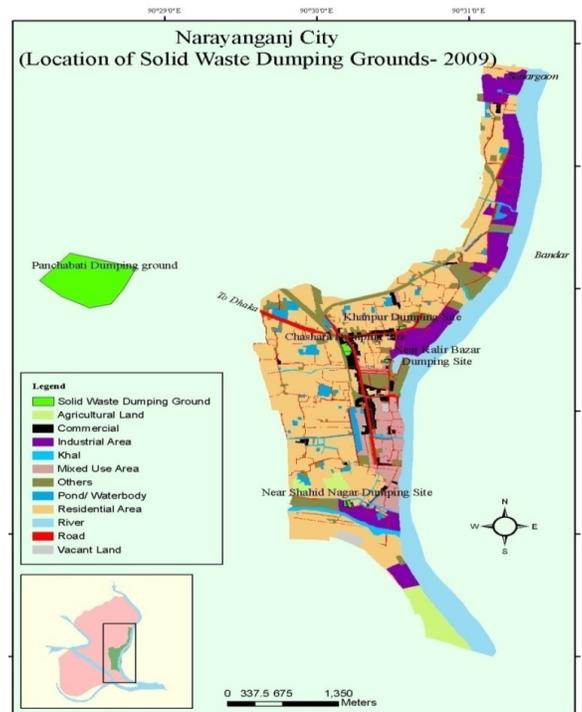
### iii. Final Disposal

Garbage Trucks and Carriers bring the collected solid wastes to the selected dumping sites. There are five dumping sites that are located at Panchabati, Khanpur, Chashara, Kalir Bazar and Shahid Nagar owned by the pourashava authority. City wastes are only being used for filling low-lying lands. Waste is presently being disposed of mainly on a government owned vacant lowland at Panchabati that is about 2.5 kilometer away from Narayanganj Pourashava area and a number of minor sites which are operated in an uncontrolled manner without any proper earth cover and compaction.

### Ultimate Disposal Sites of Narayanganj City

Disposal site can be regarded as an important component of integrated waste management in urban areas (Kazi *et al.*, 1999). The sites need to be safe, long-term and reliable for disposal of solid wastes. Currently there are five sites to dispose the daily generated solid wastes of Narayanganj city. Among them four are used by the communities of the municipality and the remaining one which is located outside the pourashava boundary is used by the municipality authority.

**Map-2: Major Solid Waste Dumping Grounds in Narayanganj City, 2009.**



Source: Field Study, 2009.

The only disposal site used by the Pourashava is located at Panchabati, outside the city. The Narayanganj- Muktarpur road is passed alongside the site. The greater part of the site is flat. The site is free from flood. It is 2.42 km away from the center of Chashara, Narayanganj. The municipality authority deposits 120-125 tons of wastes daily and other 180-200 tons of wastes come from Panchabati residential area, Fatulla, Enayetnagar and other surrounding areas. Unauthorized (not declared as dumping sites by the authority of municipality) but significant amount of wastes deposited in the four areas of the city. These are located at Chashara (near rail station), Khanpur (near ice factory), Kalir Bazar and Shahid Nagar. All the sites are located in low land areas. Out of the four, two sites namely Khanpur and Shahid Nagar, are affected by flood. Community based household wastes and commercial and medical wastes are disposed of daily in these sites. About eight to ten tons of wastes are disposed of in each of the sites per day. A large number of adverse impacts may occur from the solid wastes dumping grounds of the city. The dumping grounds are responsible for surface and ground water contamination, noise pollution, air pollution etc in and around the dumping sites.

### **Environmental Aspects of Solid Wastes in Narayanganj City**

The problem of solid waste management and consequent impact on the environment is critical in Narayanganj city. The environment in many parts of the city bears sign of polluted environmental condition in respect of surface and ground water contamination, air pollution etc because of the accumulated uncontrolled garbage on the roads and drains filled with solid wastes and human feces in the low and middle- income areas of the city. Solid waste disposal possesses a greater problem as it leads to land pollution because of open dumping, water pollution because of dumping in low lands and air pollution because of burning (Akter *et al.*, 1997). Narayanganj is facing serious environmental degradation such as land, water and air pollution and public-health risk such as skin disease, asthma, diarrhea and even skin diseases etc due to uncollected disposal of waste on streets and other public areas, drainage congestion by haphazardly dumped wastes and contamination of water resources near uncontrolled dumping sites. Leachate, gas, odor, noise and dust etc are the common environmental problems in the existing sites that cause threat to human health and nature. The environmental conditions of all the five dumping sites as investigated are described in the following sections.

### **Surface Water Contamination**

Surface water is also contaminated because solid wastes are also dumped at near the pond, canals and the river Shitalakhya the water of which is used for fishing purposes, even sometimes for households. Ponds nearby the dumping sites are mainly used for fishing, swimming and domestic uses where the canals are used for fishing. Contaminated water is harmful for fish and aquatic lives. There is a possibility of different diseases by reducing the amount of oxygen in the water (Bhuiyan *et al.*, 2003). Chemical and oil spills contaminate water that kills water floral-faunal species and other wildlife. In the entire studied Ultimate Disposal Sites (UDS), there is no control of waste contents; as a result several types of hazardous wastes are also disposed of with the main

stream of the river Shitalakhya and with the canals of the city. The study finds that the release of toxic components such as Total Dissolved Solids (TDS), Electric Conductivity (EC) etc from dumping sites are mainly responsible for the contamination of pond, canal and river water bodies adjacent to the mentioned dumping sites (table-2). It is noted here that the values occurred for some physic-chemical parameters such as Dissolved Oxygen (DO), pH, Biochemical Oxygen Demand (BOD), Chloride by laboratory analysis for the stations of surface water bodies are not fit with the standard values set by the Department of Environment (DoE) of Bangladesh.

**Table-2: Results of laboratory analysis of different surface and ground water quality parameters (mg/l, except pH) during pre-monsoon.**

Sample Name	Color	Do Std.= 4.0-6.0	pH Std.= 6.5-8.5	Sal Std.= 120	Ec Std.= 800- 1000	BOD Std.= 3.0- 10.0	TDS Std.= 800- 1000	Chloride Std.= 150- 600	Sodium Chloride Std.= 200	Iron Std.= 0.30- 1.0
S1	Transparent	0.8	7.3	320	495	0.89	571	80	128	0.5
S2	Transparent	1.4	7.1	313	504	0.45	510	80	128	0.3
S3	Transparent	1.4	7.1	234	512	0.27	490	100	160	0.5
C1	Light Gray	0.7	6.8	325	565	0.18	1000	120	192	0.8
C2	Slightly Turbid	1.3	7.3	319	589	0.36	793	120	192	0.6
C3	Light Gray	0.5	7.2	300	548	0.20	1146	200	320	0.7
P1	Green	3.5	7.7	280	526	2.5	906	140	224	1.2
P2	Light Green	1.5	7.4	286	534	0.45	991	200	320	0.4
G1	Transparent	2.7	6.7	216	439	1.34	638	140	224	0.2
G2	Transparent	3.4	6.8	225	456	0.45	497	80	128	0.4

*Std.= Standard Values guided by DoE, S= Stream, C= Canal, P= Pond, G= Ground water*

Source: Laboratory Analysis, 2009.

## Ground Water Contamination

In Narayanganj city ground water is a very much essential source for drinking and other purposes like household and industry. Tubewells are situated nearly 50 to 320 meter far from the disposal sites and the people of the adjacent houses drink water from these tubewells regularly which is not recommended due to high probability of ground water contamination especially during pre monsoon and monsoon when ground water leaching occurs. The values of analysis of two ground water stations (tubewells) show different results from the standard values set by DoE.

## Noise Pollution

Noise pollution occurs due to waste spreading operations, having equipment, collection vehicles and compactors (Islam, N. and Shafi, 2004). Noise causes discomfort and hearing loss in human beings and other animals. Another cause of noise pollution is verbalization of different animals like dogs, birds, mainly crow. Noise pollution status is moderate in the existing disposal site, since the use of operation vehicles are very limited.

## Land Contamination

Leachate percolates to the ground and land might be responsible for the contamination of the vegetables sometimes produced in the lands near the disposal site, though after in a little scale. These can cause threat to the environment and pose a risk to human health and nature. Hazardous wastes are also dumped in the site that can pose threat to human health and environment.

## Air Pollution

Air pollution is the concentration of air at the presence of various toxic and hazardous substances. The unauthorized (no legal permission from the municipal authority) and abandoned burning of waste at the existing disposal site causes air pollution. Burning of waste including partly hazardous and clinical waste, creates smoke, which releases toxic compounds and ashes into the air that is threat to the environment. However Burning is also done, at limited scale, in all the sites. As no daily covers are used, dusts as well as unwanted green house gases mixes with the atmosphere and pollute the air (Islam, N. and Shafi, 2004).

## Odor

Odors are a complex mixture of gases, vapors and dust. The potential health impact of odor depends on the concentration of odorous emissions as well as frequency and duration of exposure. Questionnaire survey (table-3) reveals that odor is a significant pollutant at solid waste disposal areas of Narayanganj city.

**Table- 3: Resident's Perception on Environmental Aspects of Five Solid Wastes Dumping Grounds of the City.**

Impacts on Surrounding Environment	Variable													
	Surface Water Contamination		Ground Water Contamination		Noise Pollution		Land Contamination		Air Pollution		Odor		Nuisance for Neighbor	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Less	21	17.5	36	30	18	15	24	20	05	4.2	08	6.7	09	7.5
Moderate	43	35.8	23	19.2	59	49.2	39	32.5	43	35.8	29	24.2	36	30
High	56	46.6	61	50.8	43	35.8	57	47.5	72	60	83	69.2	75	62.5
Total	120	100	120	100	120	100	120	100	120	100	120	100	120	100

Source: Questionnaire Survey, 2009.

Narayanganj municipal authority is falling short in providing a satisfactory service to the city dwellers with its limited resources and a poor management plan. A derisory information base on the quantity, type and characteristics of wastes; poor operation and maintenance of service facilities and above all, a lack of civic awareness on the part of a section of the population are together leading to the worsening environmental condition.

### **Existing Limitations**

Despite the efforts of the municipal authority there are some problems associated with the current management system of solid wastes of the city. The municipal authority has no scientific and engineering approach on solid waste management planning approach. It has no solid waste management specialist with engineering background. City planning department is yet to allocate any specific space for storage of waste bin and placing of container. Placing of dustbin on the road, near any house creates social problem because of improper use, irregular cleaning and road blockage by collection vehicle, bad smell, rodent, vermins, flies and unhygienic condition. Open truck collection system needs average 2-3 hours for loading and unloading the waste to and from the trucks. Municipal authority normally spends only about 0.75 million taka for providing the service that is not sufficient to carry such kind of huge loads of solid wastes. Inefficient management of existing manpower, equipment, other resources, unscientific and inefficient collection practices, inefficient management of landfill and lack of sufficient funds make the management system more vulnerable.

### **Suggestive Measures**

The findings of the study suggest some measures to efficiently manage the solid wastes and to take necessary steps for environmental degradation such as surface and ground water contamination, air pollution, noise pollution and odor due to inefficient management of solid waste of the city. It needs to maintain a scientific and engineering approach by the city authority for solid wastes management. Scientific and efficient collection practices, efficient management of landfill and sufficient manpower and funds are vital for this. The municipal authority should strictly maintain all the five dumping grounds. To prevent surface and ground water pollution it needs to separate the collected wastes into hazardous and non-hazardous materials. The appropriate solid waste disposal method has to be selected, keeping in view that it should be economically viable, should not create health hazard, should not cause adverse environmental effects, and should not result in unpleasant sight, odor, and noise. In order to prevent landfill leachate pollution of groundwater, the landfill must be impermeable to take effective measures to end. It needs to strengthen legislation, strengthen management, minimize or control the use of non-degradable plastics for daily use. Overall, the public awareness is vital for solid wastes management of the city.

### **Conclusion**

For managing solid wastes of a city, community based projects have demonstration effect. NGOs can play an important role in initiating, innovating new concepts, providing technical knowledge and providing training to others. In Narayanganj city a large number of residences are not aware about the impact of unplanned waste disposal on health and solid waste related problems. Many households are disposing garbage in nearby open spaces. Therefore, it is important to launch a long-term awareness and campaigning programme in the area so that people get motivated about

enhancing own environmental conditions willingly. Narayanganj Pourashava does not yet have any solid wastes recycling project.

However, wastes which have market value are being reclaimed or salvaged for recycling. Recycling contributes to resource conservation as well as environmental protection. Papers, broken glass; metals, plastic, etc. are purchased from house to house by a class of mobile purchasers. A section of the poor people collects reuseable and recyclable waste materials from the dustbins/containers as well as from the streets and the dumping sites.

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