STRATEGY OF SOLID WASTE MANAGEMENT IN PATNA

(With application of GIS)

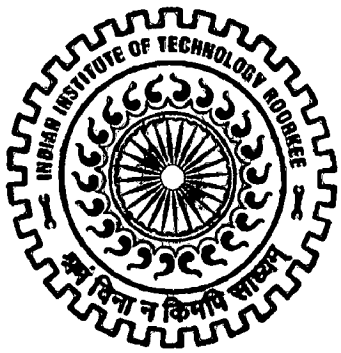
A DISSERTATION

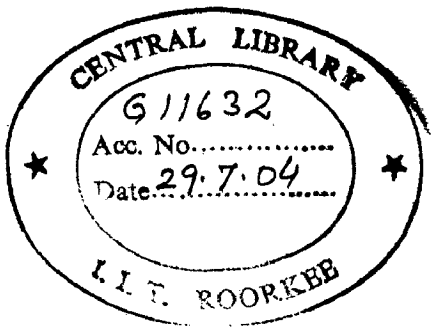
Submitted in partial fulfilment of the requirements for the award of the degree of

MASTER OF URBAN AND RURAL PLANNING

By

AMISH KUMAR BHANU





DEPARTMENT OF ARCHITECTURE AND PLANNING
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
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CERTIFICATE

Certified that this report titled "STRATEGY OF SOLID WASTE MANAGEMENT IN PATNA (With application of GIS)" which has been submitted by Amish Kumar Bhanu, in partial fulfillment of requirements for the award of Post Graduate Degree in Master of Urban and Rural Planning in the department of Architecture and Planning, IIT Roorkee,Rorkee, is the students own work carried by him under my own supervision and guidance .The matter embodied in this dissertation has not been submitted for the award of any other degree.

Roorkee

Date

Prof.R.K.Jain.

Department of Architecture and Planning

India institute of Technology, Roorkee.

CANDIDATES DECLARATION

I here by certify that the work which is presented in this thesis [illegible] report titled "STRATEGY OF SOLID WASTE MANAGEMENT IN PATNA (With application of GIS)" which has been submitted by Amish Kumar Bhanu, in partial fulfillment of requirements for the award of Post Graduate Degree in Master of Urban and Rural Planning in the department of Architecture and Planning, IIT Roorkee, Roorkee, is an authentic record of my work carried out during the period from August 2003 to June 2004 under the supervision of Shri R.K.Jain.Department of Architecture and Planning ,India institute of Technology, Roorkee, India.

The matter embodied in this dissertation has not been submitted for the award of any other degree

Date: 15-06-04

Amish Kumar Bhanu
Amish Kumar Bhanu

This is to certify that the above statement made by the candidate made by the candidate is correct to the best of my knowledge

Prof.R.K.Jain.
Department of Architecture and Planning
India institute of Technology, Roorkee.

Date

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Amish Kumar Bhanu

AMISH KUMAR BHANU

LIST OF ABBREVIATIONS USED

SWM	Solid waste management
SW	Solid waste
MSW	Municipal solid waste
PMC	Patna Municipal Corporation
PRDA	Patna Regional Development Authority
GIS	Global information system
GPS	Global positioning system
GNP	Gross National Product
ZWT	Zero Waste Technology

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CHAPTER.1

1.1. INTRODUCTION

In the ancient times man used to live in the small settlements called village .In the process of development settlements grew larger. People congregated and settlements grew larger.

At that time human settlements were small and simple in nature. There was not much problem of maintenance. Man led simple life; he lived on the mercy of nature. Nature maintained and balanced the ecology of settlements. Even today there are not much maintenance problems in the villages.

Nature balances itself or it can be said that nature is able to balance itself. Nature needs time to balance itself but today the production of the waste is too fast for the nature to balance it. When man used to live in villages he was near nature. There was no problem of waste management system because there was plenty of space in and around villages or even the small towns the settlements were built having enough spaces in and around them.

After industrialization the situation changed due to industrialization, industries were set up in the towns, people concentrated in the towns. They concentrated here in search of employment better living conditions. Thus cities grew and became larger. More the industrialization larger was the town. More number of people wanted to live in small area thus the density of the towns increased. Society got complex, the rural characteristic of the villages disappeared. Urban society came into existence. Various type of institutions, functions took place in the towns or cities .The society became complex. In the same area various types of activities were performed. Thus the cities became complex in nature.

Now, the complex functioning of the cities gave rise to many maintenance problems. It is beyond the capacity of the nature to maintain the ecology of the city because it acquired complex form.

Among the various problems which arose in the cities were the waste disposal whish is one of the ecological problems of the modern human settlements.

It is the law of the energy that it can not be generated nor destroyed. Only the form changes. It is same with the physical matters. In the complex society man consumes more and more energy and physical matters. During the transfer of energy from one stage to some energy is wasted. Which is the waste product? Same is with the physical matters. More will be the consumption more will be the by products or wastes. Now a day it is fashionable to consume more. The development of any country is measured in the consumption of energy steel, cement, petrol, food, products, processed food products, garments etc. this will lead to production of waste. So we can make conclusion that more number of activities will produce more waste.

When waste is produced more then it has to be managed more efficiently. Large is the city more quantity of waste will be produced. So in larger city management of solid waste is much desired. The production of waste is directly proportional to population. So in dense area where large numbers of people live in small area the waste will be produced more in comparison to same area having lesser population.

Due to rapid growth in population cities are growing larger and denser. Cities are getting polluted due to the production of various type of wastes produced in the city. Among the pollutants solid waste has its major role.

Unfortunately in India, the issue of solid waste management has not attained its due attention. Ill managed, corrupt, inefficient municipal bodies don't pay much attention to this problem. Sometimes infectious diseases spread rapidly claming number of lives. In the spread of the infectious diseases the dirt in the city acts as catalyst. Solid waste among the residential areas act as birth place of harmful virus and bacteria. The health and environment of city depends on cleanliness of the city.

Some years ago her highness the queen of England visited our country. During her visit she was passing through roads of Delhi. She used handkerchief to cover her nose. Her comment was that *Delhi is dirty and smells bad.* Her comment *was national shame* for us. We can easily imagine that if the municipal bodies are not efficient in National capital what will be the condition of the other smaller cities. How efficient will they be?

It is well established fact that the public health is directly related to management of solid. Plague attacks in modern India neglects the technological advancements in India. Decision makers, administrations technocrats and planners should pay due attention to this problem.

The development in our urban areas requires that we stop degrading the urban environment. In highly unhygienic conditions of our cities and towns, the planners can no longer isolate themselves from the problem of solid wastes among other assets.

1.2 AIM:

Aim of this dissertation is to study the solid waste management system in Patna and improve the solid waste management system.

1.3 OBJECTIVES

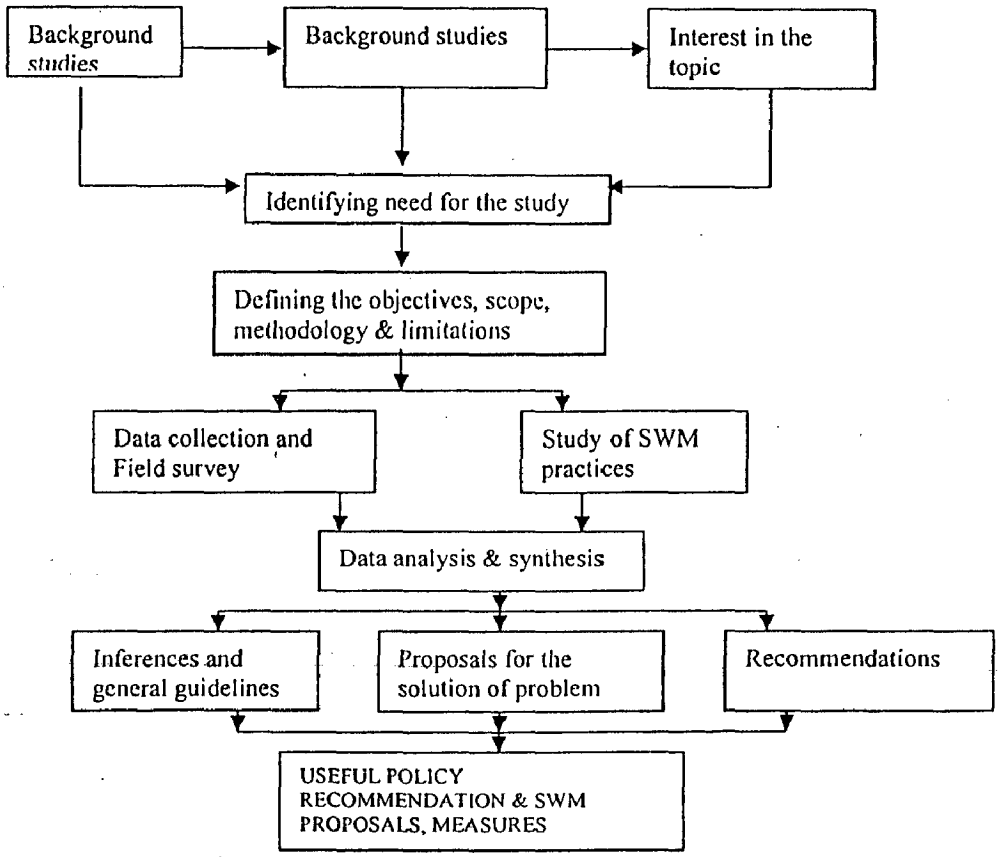
The primary purpose of municipal solid waste (MSW) management system is the disposal of solid waste and garbage from the city. Keeping the roads and streets clean.

- To encourage, develop people's participation and civic sense in the people to keep the city clean.
- To identify an efficient collection system for solid waste.
- To develop a system for the collection and disposal of solid waste.

1.4 SCOPE OF THE WORK

- The study would be within the municipal boundaries of Patna Municipal Corporation (PMC)
- The study would be limited to disposal of solid waste.
- The study is based on the information obtained from PMC and other sources.

1.5METHODOLOGY:



1.6 STUDY TOOL AND TECHNIQUE

1.6.1 DATA COLLECTION:

1.6.1.1 The purpose of the data collection was to know the actual condition of the solid waste management in Patna. To have an under standing of the existing condition of the solid waste management in Patna it was essential to have data regarding demography, infrastructural facilities in the Patna Municipal Corporation(PMC).To collect this primary and secondary data various sources and departments were contacted .The collected data was analysed to reach important inferences and conclusion.

1.6.1.2 The method of data collection was:

I. Talks with the PMC staff and workers, NGOs and residents.

II. Using the secondary sources like records of PMC, news papers, books and internet.

III. Filed survey and case studies.

1.6.1.3 The sources of data collected were:

Primary data: In order to collect primary data regarding the solid waste management in Patna discussion with PMC staff, sanitary workers, residents of different wards were done. Field notes and photographs were taken to take the direct observation of the existing condition.

Secondary data: The collection of secondary data was done approaching various departments and NGOs related to the solid waste management in Patna and case study areas. Some of the can be listed as: Patna Municipal Corporation, Lucknow Municipal Corporation, NGOs in Patna and Lucknow, Roorkee Municipal Board, Department of Census Patna.

1.6.1.4 Collection strategies involved.

1. **Interviews:** Done with the Patna Municipal workers and officers about the existing conditions of solid waste management in Patna.
2. **Field notes:** The actual number of the garbage bins and the efficiency of solid waste management in PMC area were verified.
3. **Data collection** from the literature, papers & internet.

1.6.2 GIS IS USED AS STUDY TOOL:

Study of the existing infrastructure with respect to the needs, here also it represents the typical GIS problem, no proper maps (paper maps), it's not organized. One important thing, people use the maps and the database in the disorganized way. There is a feeling among the people that, they felt the need for any organized system like GIS, since most of the data they use as spatially related, not only it helps in viewing and also analyzing, it will help in decision making.

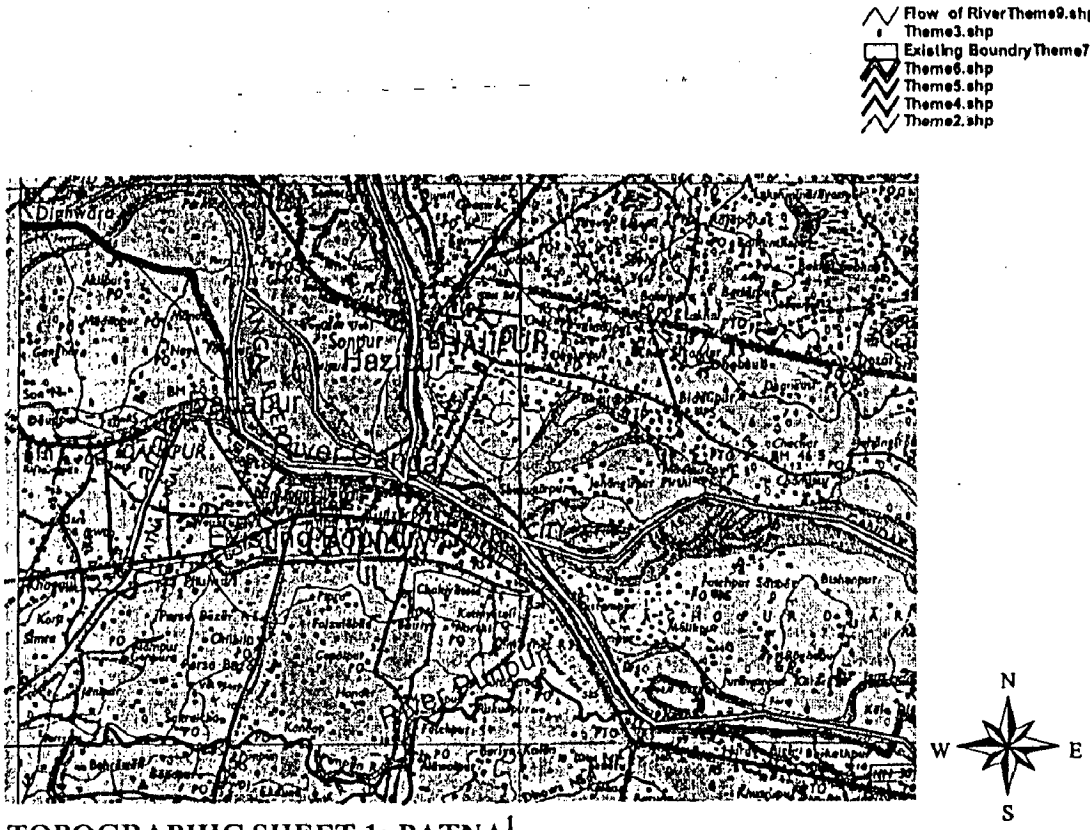
- Study and analysis of the Existing Conditions-maps, attribute data, reports, the monitoring mechanism.
- Creation of the baseline data and the waste quantity details.
- Digitizing / demarcation of the existing health ward boundaries.
- Data entry of the details – spatial and attribute – bins, routes, quantity of waste dry & wet from the city level to the health ward level.
- Generation of health ward Maps with all the existing details for 57 health wards.
- Networking and Installation of the systems in the BMP main offices and the zonal offices and creation of the monitoring center for GIS.

1.7.1 STUDY AREA PATNA

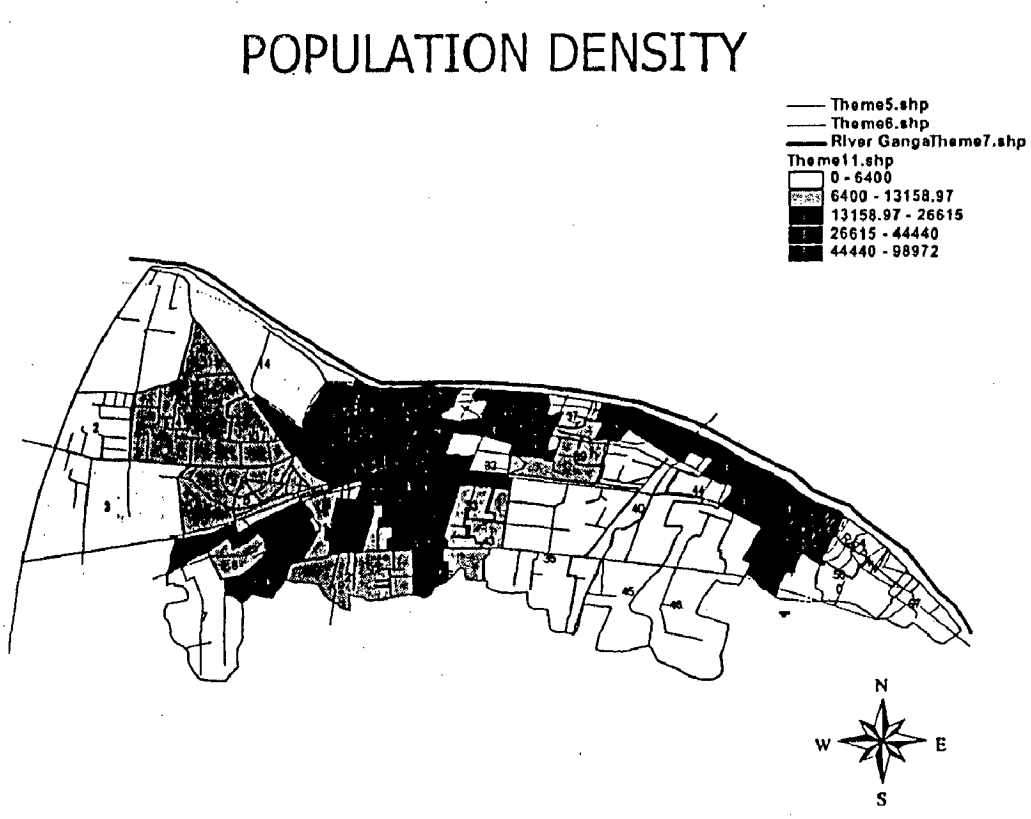
Patna is an ancient city about three thousand years old. Now a day it has attained dense and complex type of development. This city is situated on the bank of great river Ganga .This city is bounded by two rivers. On the northern side is Ganga and on the southern side is Punpun. This Punpun River is perennial River. This city is bounded by two rivers so it has attained dense development having population density more than 7200 persons per square kilometers. It is an ancient city; during the course of development it has attained complex type of development

1.7.2 PROBLEM IDENTIFICATION

General problems- Patna is the study area is the capital of Bihar. It is an old city and dense city .This is not a planned city nor any master plan been successfully implemented here. This is very dense city density more than 10 thousand persons per sq km; about six times the Bihar population density.



TOPOGRAPHIC SHEET 1: PATNA[1]



PLAN 1: Population density Patna.

(World population density 40 persons, Indian population density 307 persons per square km)[2]:

1. Its area is only118 sq kilometer with population of 13.5 lacks. It is estimated to be 18 lacks (including floating population)[3].

2. The new developed area in the southern part of the city is going in the low-lying area of the city, which is the catchments area of the river Punpun which becomes water logged in rainy seasons. The new development in this area increases the cost of infrastructural facilities due the water logging problem. That water has to be pumped out of that area. The circle in the plan shows the water logged area. Various new departments have come up to solve the water logging problem.

a. The population pressure on the city has led the unplanned development of the city. The municipal body is not able to maintain this unplanned development. In lack of efficient management of the city the municipal body cannot generate the enough revenue to run itself and meet its requirements.

b. The divisions of the wards are uneven, some wards are very large and some are small; some are very dense and some are thinly populated.

Wiswas Board
1. Which is responsible for the cleaning of the drains cleans the drains and leave the waste from the drain on the road side which remains unattended .Its neither claimed by the Wiswas board nor by the PMC. Various departments work in the same area without coordination among them.

2. Because of complex development; various agencies often over lap their duties increasing the operation costs. In the residential area commercial activities, industrial activities all run in the same area. All the type of activities pay the taxes of the residential area or both the type of taxes has to be collected from same area; resultant is the loss in the revenue for PMC. For example the Wiswas board which is responsible for the cleaning of the drains cleans the drains and leaves the waste from the drain on the road side which remains unattended .Its neither claimed by the Wiswas board.

Wiswa Bard
3. Which is responsible for the cleaning of the drains cleans the drains and leave the waste from the drain on the road side which remains unattended .Its neither claimed by the Wiswas board nor by the PMC. Various departments work in the same area without coordination among them.

1.7.3 SWM MANAGEMENT IN PTANA- In the area of 118 km^2 900 tonnes of solid waste is generated in Patna but only 600 tonnes is disposed off daily.

The types of solid waste generated are[4]:

- 54%domestic 486 tonnes
- 31%commercial 279 tonnes
- 2% hospital 18 tonnes
- 13 % industrial 117 tonnes

& constructional debris

1.7.3 COLLECTION- People generally throw the solid waste besides the road. There are almost no provision of bins for the people so that they can throw the solid waste .From there sanitary workers collect the SW in wheel barrows and dump it in the dumping points. From the dumping points PMC staff collect SW in tractors and carry to the landfill points.

1.7.4 DISPOSAL-All the type of solid waste generated is disposed off bye PMC at this time .Any type of segregation method is not applied during the disposal method .The PMC staff simply collect the waste and dispose off in the dumping points.

1.7.5 PROBLEMS RELATED TO SOLID WASTE MANAGEMENT

i. The Patna municipal corporation lacks in proper staff set up and fleet of vehicles.

ii. There is no proper system of solid waste management. Garbage bins are not placed properly at regular intervals.

iii. The disposal vehicles carry the SW in openly go on littering the SW here and there on the road.

iv. Only land fill disposal technology is involved, there is no gradation or classification of the SW before disposal.

v. No provision of disposal of hazardous waste. There are about 100 big hospitals identified which have been directed to use incinerators for the disposal of hazardous waste. But these hospitals are not using the incinerators.

vi. Commercial establishments like hotels which produce large amount of bio-degradable waste depend on the municipality for the disposal.

vii. In the Patna city Anchal there are many cottage and small scale industries running but they depend on the PMC for the disposal of industrial waste. There is no separate system for the disposal of industrial waste. The PMC staffs just dump the industrial waste in the open land.

viii. Sometimes cottage industries put their waste in drains chocking the drains.

ix. There are no fixed points for the collections of SW; people just throw the waste any where besides the road.

x. Sometimes the disposal vehicles pass through the roads at peak load hours in the congested roads.

xi. The major roads are not swept regularly; minor roads are swept occasionally or never.

xii. Sweepers don't attend their duty regularly.

xiii. PMC has no fixed and regular disposal land fill points.

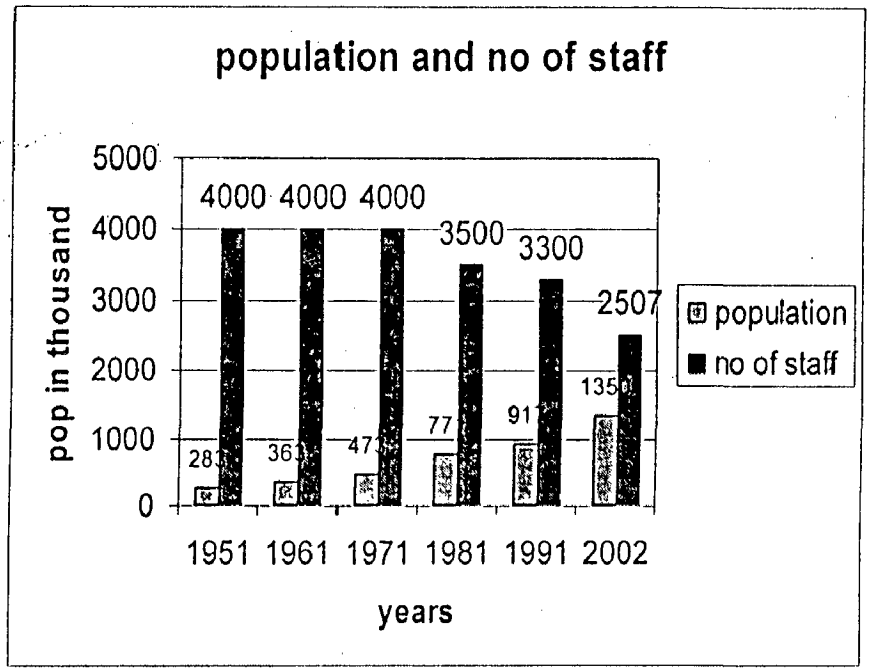
xiv. There is no enough land for the future development of Patna. So in future with the increase in population the existing disposal points will also disappear.

xv. PMC has no incineration plant to process the hazardous waste.

xvi In the rainy season the SW rot in low lying area and spread water born diseases .

1.7. 6 SOLID WASTE MANAGEMENT AND STAFF SET UP

When PMC was established its area was only 20 mile^2 population was only 2.83 lacks the no of wards were 37, the no of staff engaged in solid waste management were 4000.



GRAPH 1: Population and number of staff[6]

With the increase of time population as well as area of the town increased but the number of staff did not increase. This graph shows that the area of the pant is increasing but the no of wards remained .This graph shows that population of the City went on increasing and the number of staff went decreasing. At this time when the population is about 13.5 lacks only 2507 sanitary staff are engaged in the solid waste management system. This is only 1 sanitary worker per 538 populations against the UN standards of 3 sanitary workers per 1000 population. The resultant is poor SW management system.

1.7.7 EFFECTS OF POOR SOLID WASTE MANAGEMENT SYSTEM ON ENVIRONMENT OF PATNA

The impacts of the poor management system are as follows:

I. Poor environmental condition of the city- this state capital of the Bihar and also important tourist place in the country. Due to poor environmental conditions this city could not gain enough popularity as tourist place.

II. Poor aesthetical condition of the city.

III. Poor health conditions in the city.

IV. Low revenue generation; low income of PMC.

1.7.7.1 EFFECT OF BAD PLANNING ON SOLID WASTE MANAGEMENT

After independence many master plans were prepared they could not be implemented due to lack of will power of the implementing authorities. Zoning regulations could never be implemented .In lack of proper zoning mixed type of development has taken place. At the same place commercial and residential; industrial and residential; educational and residential type of activities are going on.

The unplanned development of this city has increased the maintenance cost of this city and reduced the revenue generation capacity of local governing body. The municipal body is capable to generate enough revenue to meet its increased requirements through its ill managed machinery.

1.7.8. PROBLEM IDENTIFICATION

Solid waste disposal in Patna is done by Patna Municipal Corporation (PMC). It is responsible for the maintenance of Patna municipal area.

PMC has total 57 wards having population of 14 lacks (as shown in PLAN 2) and area 118 km^2. There is no separate department for the management of solid wastes in PMC .In each division this wok is done under the supervision of sanitary inspector.

In the morning sweepers start seeping the roads and collect the garbage on the collection points People throw the garbage on the road side or in the garbage points. The municipality is very ill maintained, lacks in fund, staff and management.

Patna is growing at the rate of 50% decadal growth or even more (there is no record of unauthorized construction and population). Due to the negligence of development authorities Patna is developing rapidly but in unplanned manner. The

haphazard growth and lack of zoning regulations and implementations unplanned growth is taking place.

Mixed development has resulted rise of various activities in the same area. In the residential area small scale industries, nursing homes, shops, hotels, automobile work shops all are running in the same area making management of the city complex and costly.

All produce different type of waste in the same area. They throw MSW in the same garbage disposal point. Here all different type of waste is mixed up.

1.7.9 PROBLEMS OF PATNA MUNICIPAL CORPORATION (PMC)

- The increased maintenance cost and
- Lack of staff and proper records of the area.
- Low revenue collection,
- Poor management.
- Lack of machineries and vehicles makes the situation of the PMC worse.
- Lack of co ordination from other departments.
- Frequent strikes of staff –this happens in lack of timely payment of salary.

1.7.10 Population of different wards of Patna municipal area[6].

WARD	NAME	POPULATION	VOTERS	AREA
1. Ward	N.A.	41265	24016	N.A.
2. Ward		10820	NA	
3. Ward		30299	16364	
4. Ward		71924	41860	
5. Ward		NA	NA	
6. Ward		15960	9289	
7. Ward		14390	8375	
8. Ward		11945	6953	
9. Ward		35952	24016	
10. Ward		35952	1757	
11. Ward		14390	11780	
12. Ward		42206	24564	
13. Ward		21074	12265	
14. Ward		24435	14221	
15. Ward		30897	17982	
16. Ward		16271	9470	
17. Ward		20505	11934	
18. Ward		18000	9874	
19. Ward		33800	19770	

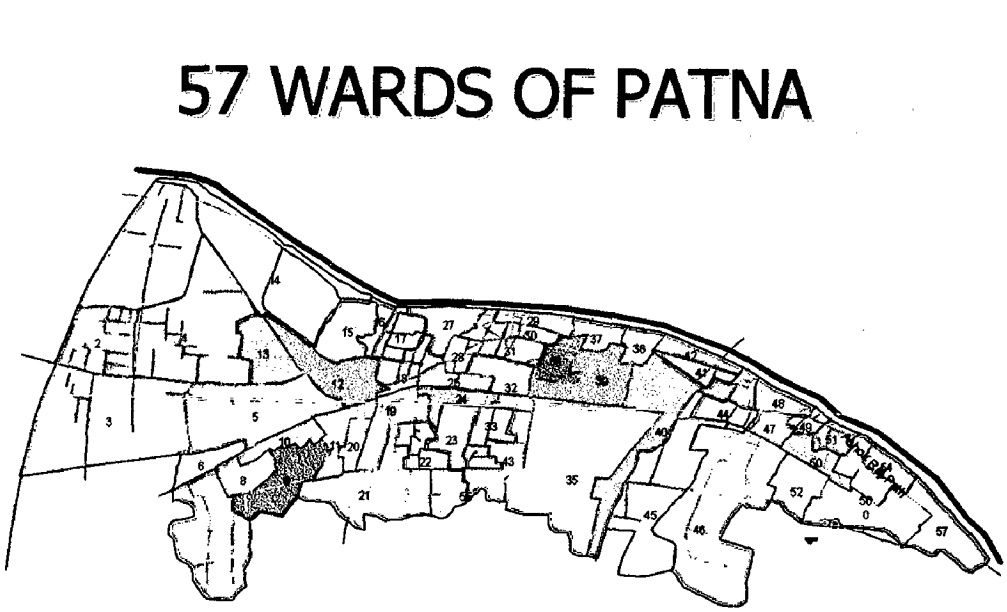
20. Ward		NA	NA	
21. Ward		30742	17894	
22. Ward		30095	117227	
23. Ward		42128	24522	
24. Ward		330092	14572	
25. Ward		29918	1923	
26. Ward		20428	11891	
27. Ward		21555	7989	
28. Ward		23109	12547	
29. Ward		23109	13451	
30. Ward		21723	12644	
31. Ward		30093	17516	
32. Ward		33963	19769	
33. Ward		15396	8946	
34. Ward		2955	17201	
35. Ward		33845	19700	
36. Ward		35630	739	
37. Ward		31681	18441	
38. Ward		31208	1865	
39. Ward		3022	17539	
40. Ward		17493	10182	
41. Ward		18365	1069	
42. Ward		28803	16765	
43. Ward		1377	8015	
44. Ward		NA	NA	
45. Ward		26125	15207	
46. Ward		23447	13648	
47. Ward		NA	NA	
48. Ward		16862	16862	
49. Ward		24925	14508	
50. Ward		22324	12994	
51. Ward		19998	11640	
52. Ward		22084	12854	
53. Ward		29352	17085	
54. Ward		12353	12353	
55. Ward		NA	NA	
56. Ward		12634	12634	
57. Ward		15969	9295	
TOTAL		1442932		118 km^2

o **TABLE 1: *Population of wards***

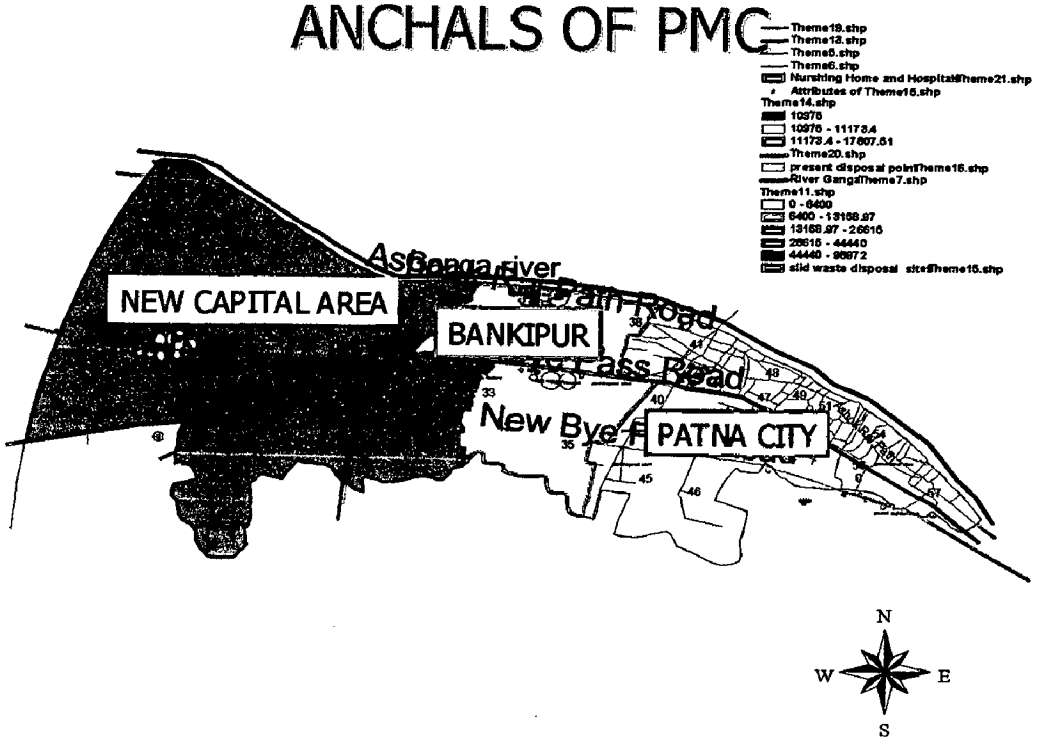
1.8. ADMINISTRATIVE DIVISIONS OF PMC

For the ease of administration there are three divisions in PMC.

1. **New capital area 2.Bankipur Anchal 3.Patna city Anchal**



PLAN 2: 57 wards of PMC[7]



PLAN 3: Showing the different Anchals of Patna.[8]

1.8.1 NEW RAJDHANI ANCHAL (NEW CAPITAL AREA)

This Anchal has 25 wards

Daily about 300 tones of garbage is produced.

Garbage produced contains plastic, husk, coal, paper. Etc

1.8.1.1 Staff set up of this Anchal

Total staff	797
No of sweepers'	n.a.
No of tractors	25
No of trippers	14
No of loader	5
No of suction machine	1
No of hand carts	175

This is the western part of Patna .Ward wise this is the largest division of Patna Municipal Corporation. This is also newly developed area including some old and congested residential areas. In this area all the important government, non govt. offices and Establishments are there. In this area all the ministers, higher, officials reside. So this is the V.I.P area of the capital.

Area wise this is large area put population density is low as shown in fig1.1. .Most of govt. residences are having large campus area which are of colonial period.

In this area residential, commercial, educational and administrative buildings are there. This area is planned so there is not much problem in maintenance in this area

residential, commercial, educational and administrative buildings are there. This area is planned so there is not much problem in maintenance.

NEW CAPITAL AREA

FIG1.1: New Rajdhani Anchal

In this photo we can see wide road,

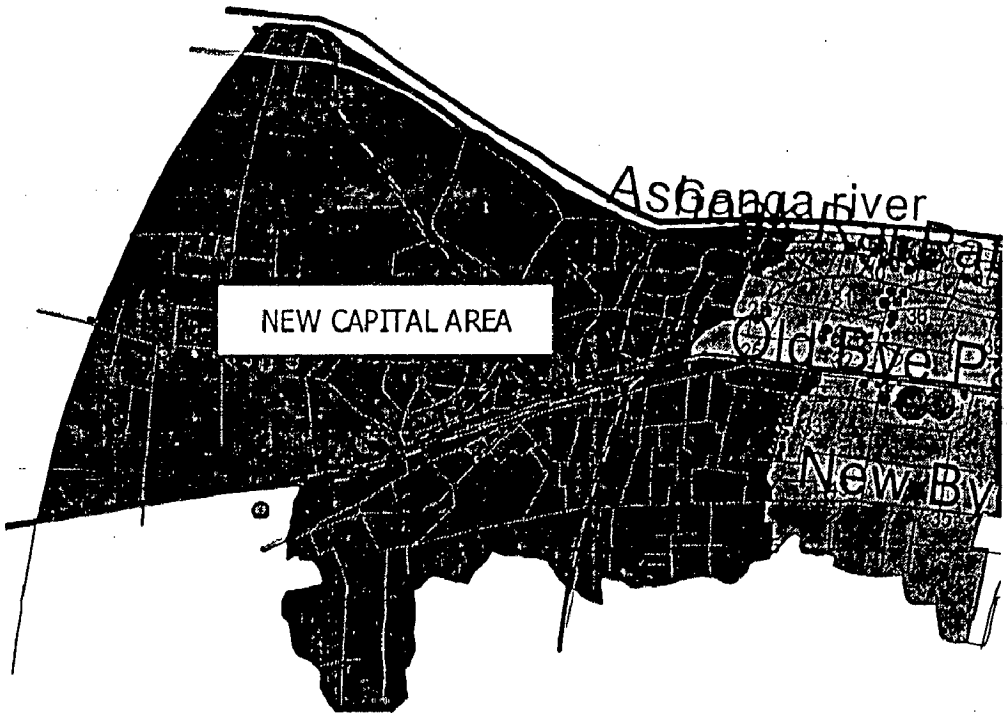
Spacious area, less density.

Any department digs the road and leaves the soil it on the road. In the course of time it gets littered on the road and weakens the road.

If it is not attended then it will be spread on his road making the movement of the vehicles and pedestrian difficult. PMC will not attend this because this is not garbage.

Staff set up of this Anchal:

Total staff	615
No of sweepers	578



PLAN 4: Showing new capital area

1.8.2 BANKIPURE ANCHAL

1.8.2.1 Introduction

This Anchal has 14 wards

Daily about 200 tones of MSW is produced.

Garbage produced contains vegetable waste, drain silt, polythene, + nursing home and hospital waste (according to municipal persons

1.8.2.2 Staff set up

No of tractors	17
No of trippers (truck)	8

No of loaders (lifter) 3

No of hand carts 100

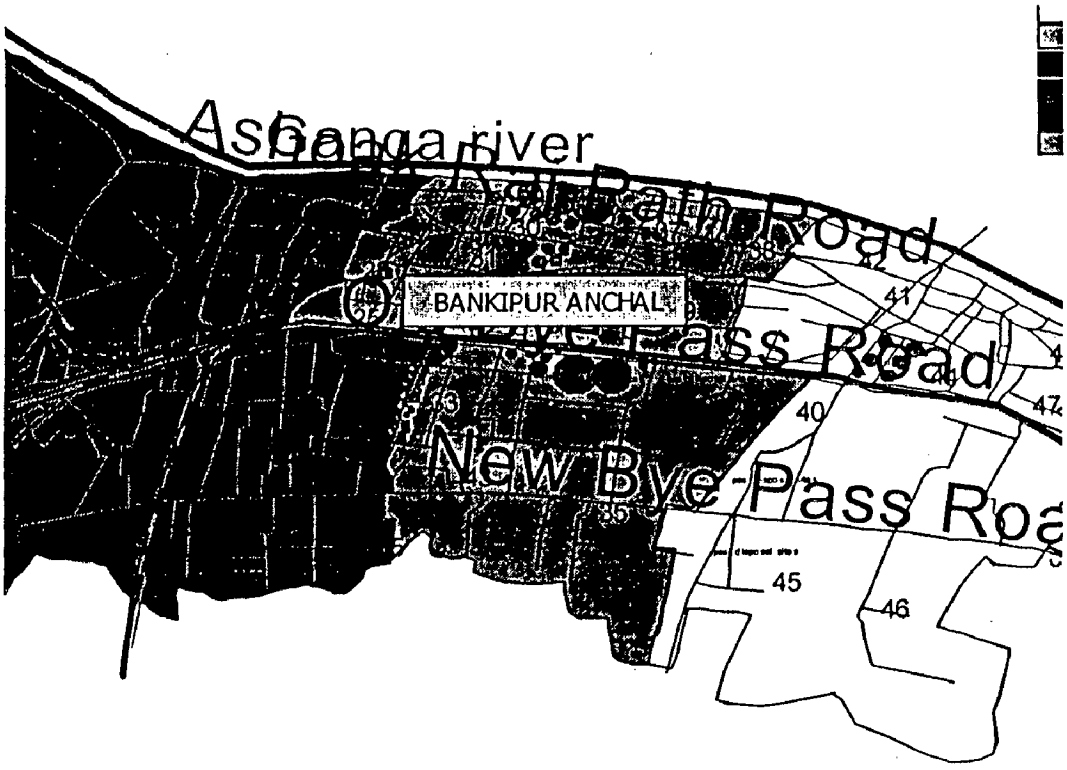
Garbage collection work is done from 6 a.m. to 5 p.m.

1.8.2.3 *INTRODUCTION*

This division lies in the middle of Patna (as shown in Plan 5).This is newly developed area. It is not as dense as Patna city .This is residential area with some mixed type of settlements. A large residential colony Kankarbagh lies in this area, which is a planned colony. There are enough open spaces, roads are wide enough. Sewerage and sewage system is well developed.

This is low lying area in comparison to Patna city area. On the northern end is Ganga; southern end is new Patna. Bye pass road. There are open spaces along the bye pass road where disposal of MSW is done by the Patna municipality. The disposal is done on both sides of bye pass road which is low laying area.

This area is composed of planned and well built houses with enough spaces around them .Residents of this area are mostly of white collar job. Literacy level is more than Patna city; residents up-to-date persons. Civic senses among the residents are average.



PLAN 5: Showing Bankipur Anchal

This area has modern urban characteristics, for cooking mostly LPG is besides other type of fuels. So there is no question of production of ash. The Solid waste produced mainly of: **Vegetable wastes** (produced from vegetable markets and residences) **Paper,** (domestic and commercial waste) **Polythene,** (domestic waste), **Plastic jars and bottles** (domestic waste), **Hospital waste** (Nursing home waste).

1.8.2.4 PROBLEMS OF THIS AREA

In this area there are 14 wards. Part of this area is low lying where Kankarbagh residential colony is situated .This is large colony having no proper garbage disposal points where public can dispose MSW.

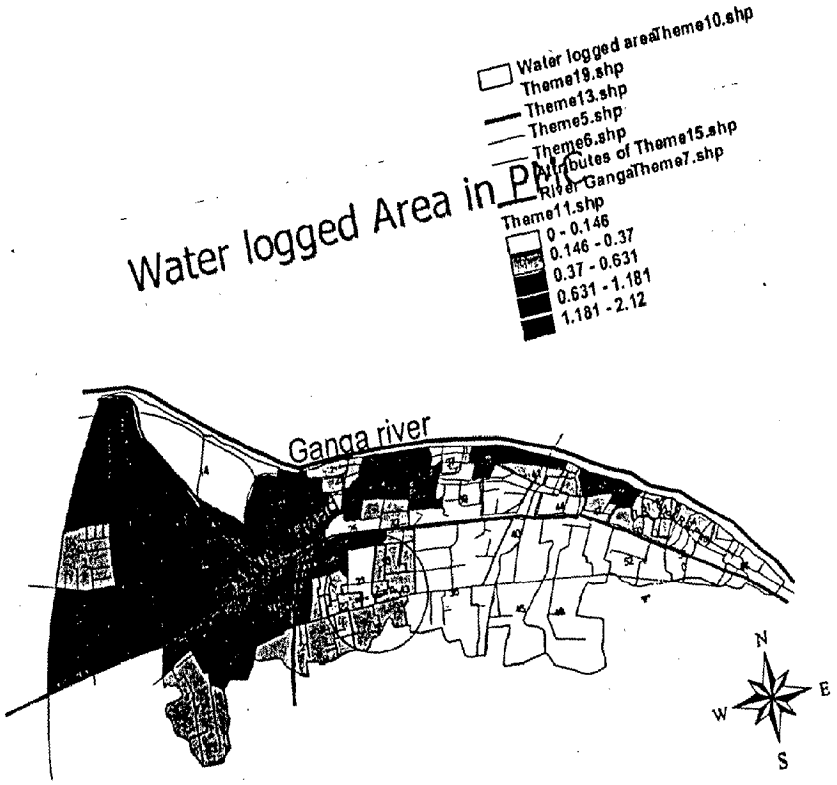
People often throw MSW in open spaces near gutters. In rainy season MSW with water enters the gutter. The decomposable organic wastes are decomposed off but polythene remains intact; this chokes the sewerage pipes. The polythene chokes the sewerage pipes. This results in water logging when the pipe becomes unable to suck the storm water. In rainy season organic solid waste rot producing pungent smell and making the environment unhealthy.

The rotting MSW often find their way in waters supply pipe polluting the water. This gives rise to stomach diseases. This area is low lying so the vacant plots act as garbage disposal point for neighbors municipal workers also ignore the MSW lying in low area. They only take care of MSW on the road side.

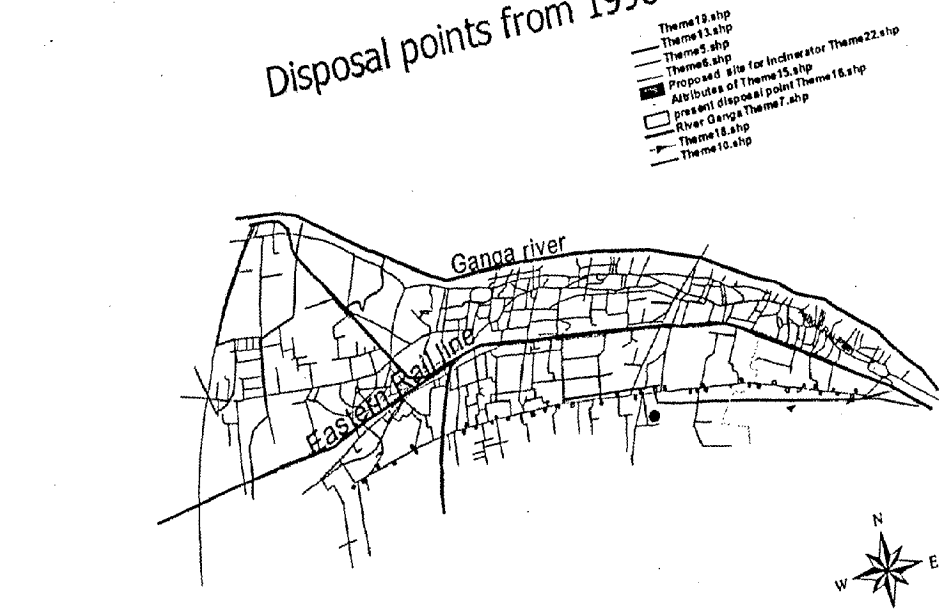
The MSW which lies in the low plots get mixed with water .this type of combination remains unclaimed either by municipality or Wiswas Board which is responsible for disposal of storm water in Patna.

In rainy season deposited dust and small particles get churned by the running of auto mobiles make a layer of scum on the road .Which makes the road slippery making almost impossible for the movement of the pedestrians. The road gets damaged by the layer of scum deposited on it. Due to this layer of scum new road gets damaged in only a season. Increasing the maintaining cost of the roads.

FIG 1.2: Transprt Nagar disposal site of refuse.



PLAN 6: Water logged area



PLAN 7: Present disposal points

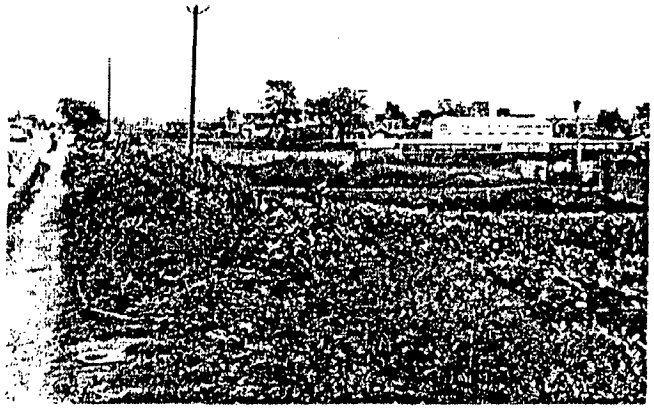
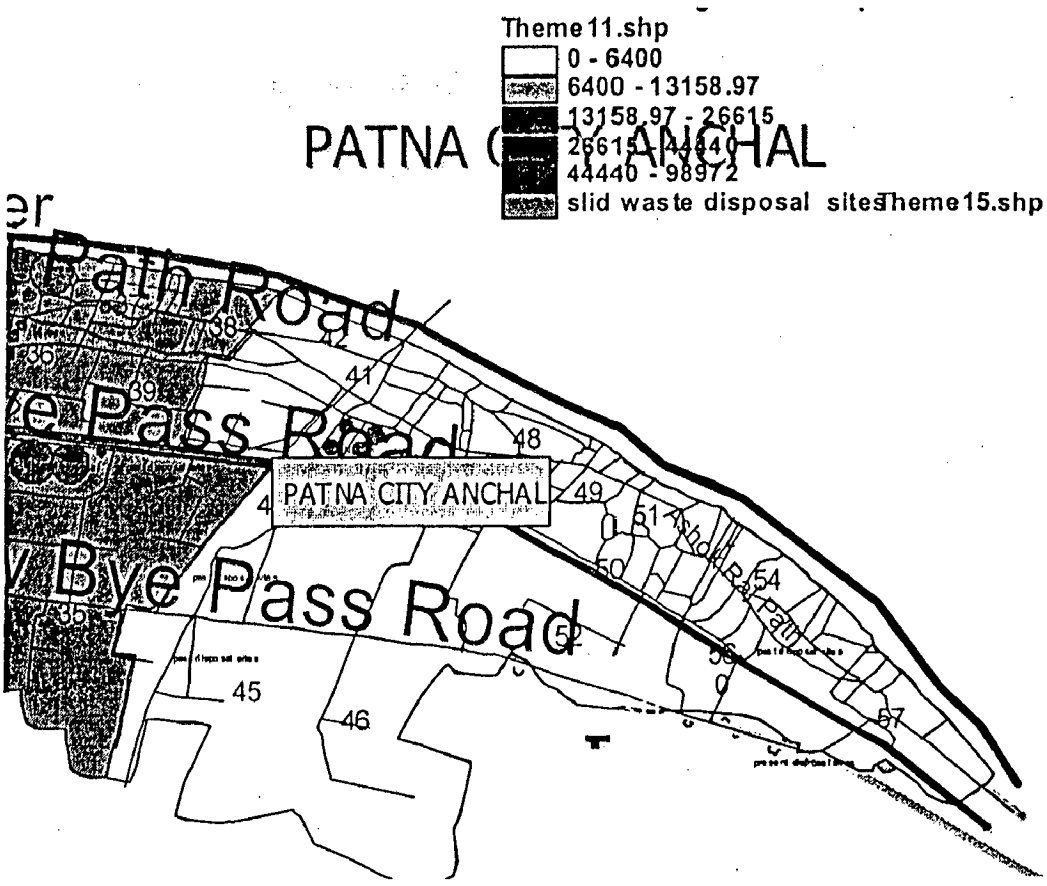


FIG1.3: New Patna Byepass road- Refuse is disposed off in low lying area besides bye pass road.

FIG 1.4: Rajendra nagar: refuse rotting in the field



PLAN 8: Patna City Anchal

DISPOSAL POINT OF PMC: On the both sides of new Patna Bye pass road (NH 30) PMC disposes off its refuse.

1.8.3 PATNA CITY ANCHAL (as shown in Plan 8)

Daily tractors make 130 trips; each tractor carries 1.5 tones of garbage.

Total garbage produced is about 200 tones.

Number of wards 18

1.8.3.2 COMPOSITION OF WASTE

Coal ash

Rubbish

Polythene

Mud

1.8.3.3 STAFF SET UP

No of tractors	19(in running condition) total 25	
No of polkan	(drainage desilter)	1
Pay loader		2
Tripper		2
Hand carts		125
Staff		657 (male 465 female192)

It has 18 wards. It is the western end of Patna. This is the area where old Patliputra was situated.

1.8.3.4 PROFILE OF THIS AREA: Once it was capital of India in the reign of Ashoka the great .After the invasion of Mughals in India again it became an important place. After the invasion of Mughal in India Sikh religion was established in Patna city the 10 th guru of Sikh religion Guru Gobind Singh Jee was born at another place near by he was brought up. At the both places there is Gurudwara which is important place in Sikh religion. This is important pilgrimage for both Hindus and Sikhs.

In the past 1000 years it developed as place of trade and commerce .Still today it has some state level grain market and other commercial places.

In thousand years of development this area has acquired very complex form and dense pattern of development .So maintenance of this area has become complex and difficult.

So this is densely populated. Settlements are very close to each other. Roads are narrow; streets are very narrow. In this area business activities are dominant .Food grains market, vegetable market, there are number of small scale industries. The number of registered industries is about 1200 but the actual numbers are even more it difficult to keep account of very small i.e. house holds industries. Actually in every alternate house some small scale industry is running. Like

- *Food processing,*
- *Food products,*
- *Bakeries,*
- *Toy makers,*
- *Idol makers,*
- *Earthen pot makers,*
- *Gold smiths,*
- *Hard ware items,*
- *Brick kilns*
- *Carpenters*
- *Local medicines,*
- *Cosmetics,*
- *Iron smiths,*
- *Shoe makers,*
- *Tanneries*
- *Paper marts*
- *Paper products*
- *Plastic works*
- *Ready made garments,*
- *Agro based industries*
- *Junk processors*
- *Repairing shops*
- *Cold stores*
- *Electronic items*
- *Repairing shops*
- *Rag pickers*
- *and many more*

The problem is that all of these industries run in the residential houses or are situated in residential areas .So all the industrial and commercial activities are running in this area .There is no separate industrial area for these activities .Most of these are situated in narrow streets and roads. The streets are too narrow for the frequent movement of the people. So there is no question of free space for the collection of garbage for the disposal i.e. garbage point.

All the above said activities produce industrial wastes. There is no proper system of disposal of industrial wastes .These are collected and disposed off with the domestic wastes .The disposal of industrial municipal solid wastes (MSW) like plastic wastes produce problems. There is no separate system for the disposal of industrial wastes.

Its boundary starts from Nanmuhi more. On north is Ganga; on south is bye pass road; on East is the Bankipure division. In this division on average about 200 tones of garbage is produced. Garbage is composed of: Organic materials- produced from Anaaz Mandies (food grain market, Sabzi Mandies vegetable markets).

1.8.3.5 PROBLEMS OF THIS AREA

In the Patna City Anchal the residents are mostly from lower middle class. Their income and level of education is low .Here rural characteristics can be seen in the residents. About 80% of the residents use coal and cow dung for cooking.

This produces ash People don't take care of its disposal and let it go in the drains or scatter around the house or the roads. It goes in the drain and chokes the drain the up stair residents don't bother to come down for the disposal of waste; they simply make the packet of MSW and throw it down in the streets or besides roads. This habit results conflict among the neighbors. Sometimes this conflict goes to courts also. Municipal workers also find it difficult to collect the scattered MSW.

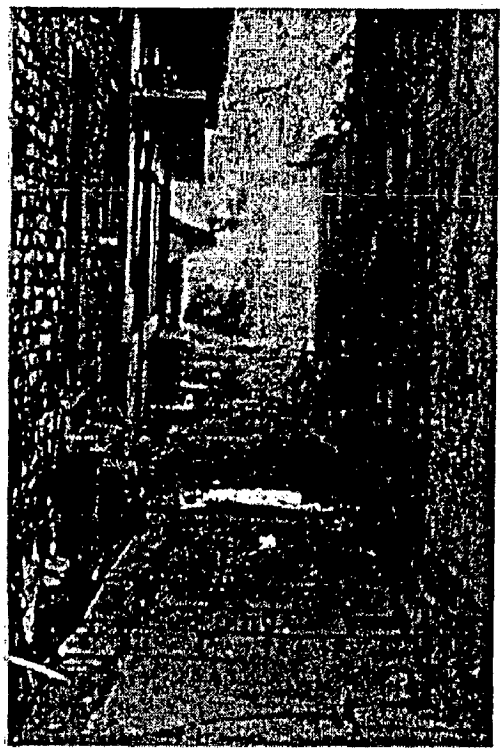
Municipal workers start their cleaning work at 5 a.m. up to 10 a.m. they clean the streets and road. At 10 a.m. shopkeepers open their shops at clean their shops. After cleaning they collect the garbage and throw it besides the road. This habit makes the roads and streets again dirty.

They don't bother to throw garbage on the garbage points. The scattered MSW is often left unattended by the municipal staff.

1.8.3.6 HEALTH PROBLEMS

The effect of poor garbage disposal system makes the environment unhealthy. It makes the environment unhealthy for the health. In the rainy season the situation becomes worse.

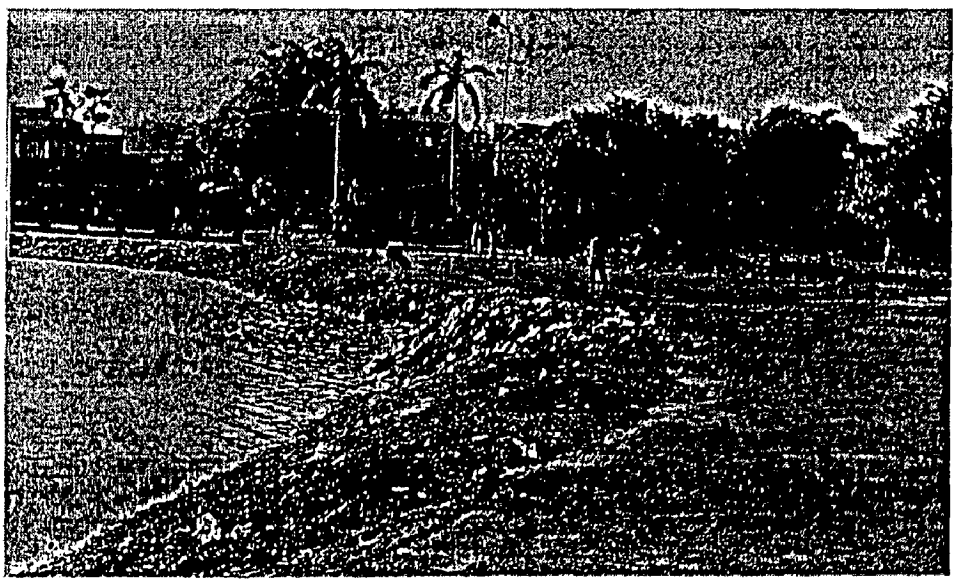
The unattended garbage rots producing pungent smell. This proves hazardous for health, viruses, pathogenic germs; harmful bacteria breed in the garbage heap. These pathogenic germs find their way in the water supply system .these pathogenic give rise to stomach problems like diarrhea, cholera, typhoid, flue, influenza. This condition proves very suitable for viral diseases to spread rapidly making people ill.



The rotting MSW often find their way in waters supply pipe polluting the water. This gives rise to stomach diseases

FIG1.5: Narrow lane of Patna city. Street is too narrow to let the garbage collecting vehicles and sunlight to come. No space for putting garbage bins, disposal point. The area is too old having dense and fine grain settlement.

FIG 1.6: Mangal talab:



Park in Patna city area. Besides maintaining it .MSW is unhealthy thrown on bank of the water body which rots and pollutes the water making the whole environment

FIG **1.7: Rag pickers** (kabariwala) taking old news papers to the grey market for recycling it.

FIG **1.8: Rag pickers recovering waste** paper to sell them in grey market .They play important role in the recycling of waste and reducing the amount of waste. Indirectly they work for the zero waste technology.

Recovering from the waste they are selecting Polythene bags to sell them in grey market. Making profit by recycling waste is their profession. These rag pickers play important in recycling the waste they collect the waste from the refuse thrown besides the roads. By recycling the waste they reduce the amount of waste to be disposed off by the PMC. By the segregation of waste they separate the non decomposable waste which causes problem in decomposition of waste.

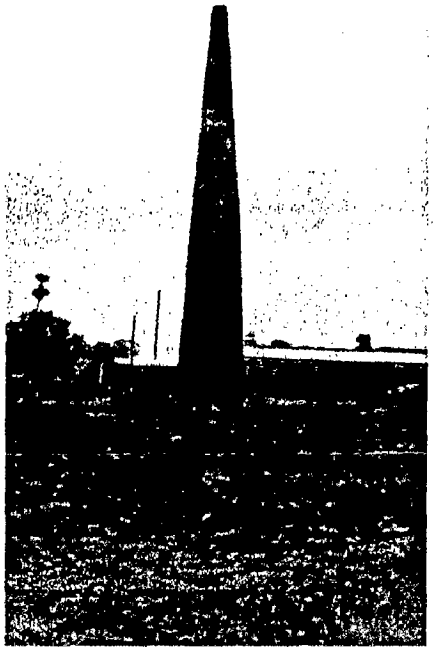
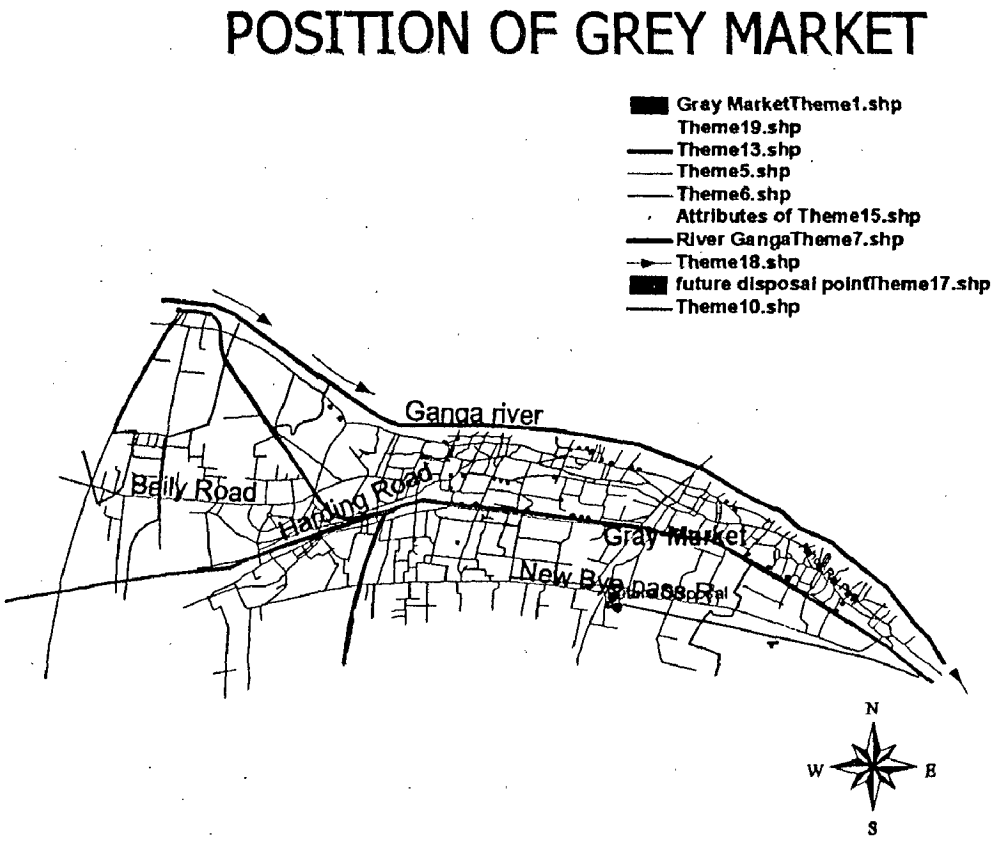
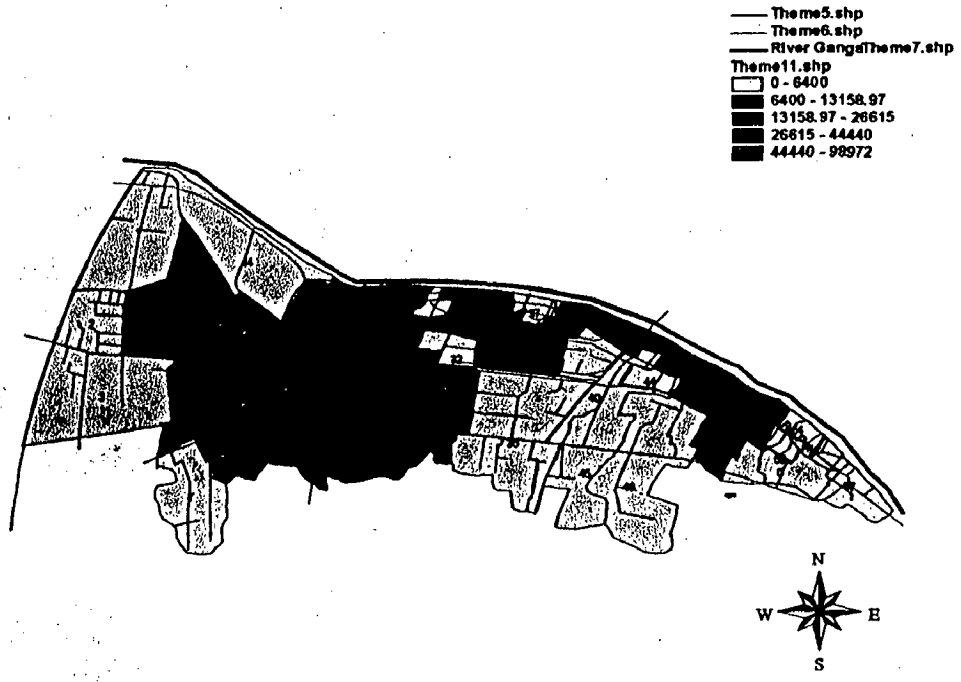


FIG **1.9, 1.10: Brick kiln in Patna city area.** This brick kiln is situated on the banks of river Ganga.



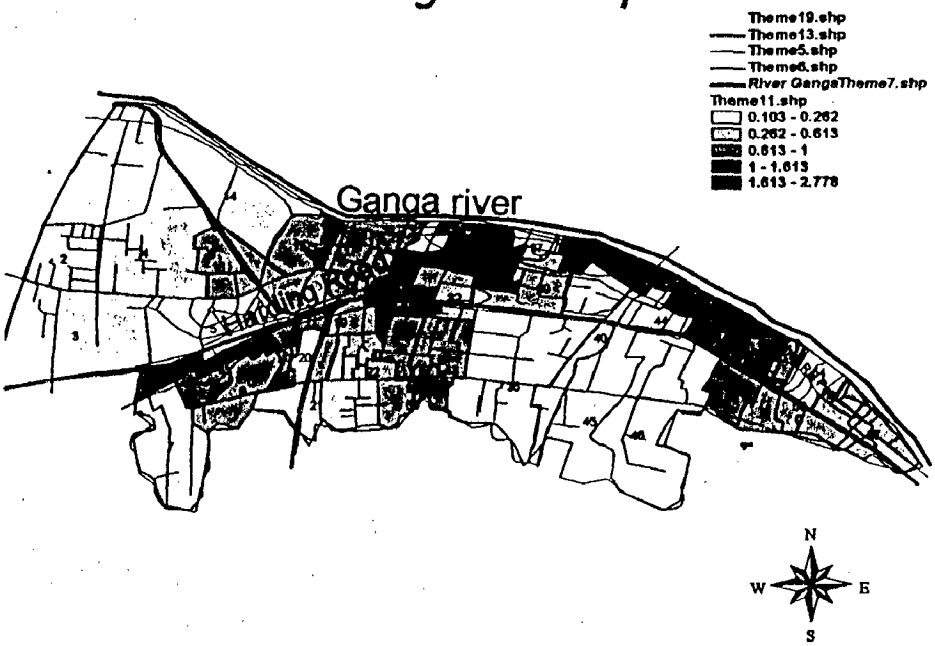
PLAN 9: Position of grey market.

POPULATION DENSITY



PLAN 10: Showing population density

Garbage density



PLAN 11: Showing garbage density

References.

1. Survey of India.
2. Website google.
3. Patna Municipal Corporation. (PMC)
4. NIUA
5. PMC
6. ibid
7. ibid
8. ibid
9. ibid

CHAPTER.2

2.1 LITERATURE STUDY 1

WHAT A WASTE: SOLID WASTE MANAGEMENT IN ASIA

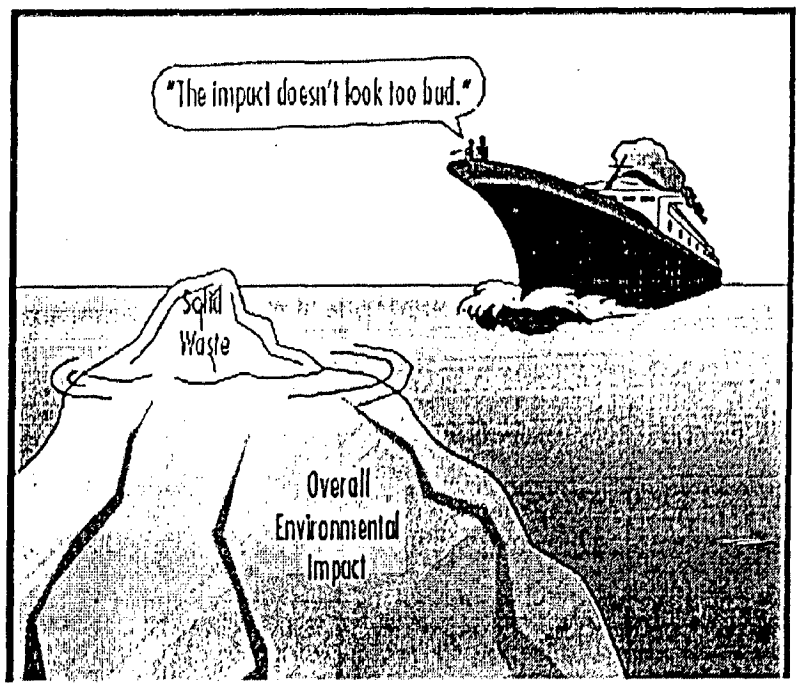
1. Introduction: Solid Waste Management in Asia

As urbanization and economic development increases in Asia, nowhere is the impact more obvious than in society's "detritus," or solid waste. Today, the urban areas of Asia produce about 760,000 tonnes of municipal solid waste (MSW) per day, or approximately 2.7 million m3 per day. In 2025, this figure will increase to 1.8 million tonnes of waste per day, or 5.2 million m3 per day. These estimates are conservative; the real values are probably more than double this amount.

Local governments in Asia currently spend about US $25 billion per year on urban solid waste management. This amount is used to collect more than 90 percent of the waste in high income countries, between 50 to 80 percent in middle income countries, and only 30 to 60 percent in low income countries.

In 2025, Asian governments should anticipate spending at least double this amount (in 1998 US dollars) on solid waste management activities.

To carry out integrated solid waste management, local governments need partners. National governments must reduce the externalities of waste by considering measures such as full cost accounting, package deposits, manufacturer responsibility, and extended product care.



The general community, which is probably the most important stakeholder in waste management activities, must also actively, participates in the solutions by modifying their behavior patterns. For example, they need to exert discipline in

separating waste, using containers in a beneficial way, and exercising environmentally friendly purchasing habits. This paper reviews the broad trends related to solid waste management in Asia1. "The big picture" projects regional urban MSW quantities and compositions in 2025. The forces of these trends are analyzed, and preliminary suggestions for reducing the impact of these trends are provided. The paper also briefly discusses possible policies and budget requirements for dealing with this burgeoning waste stream.

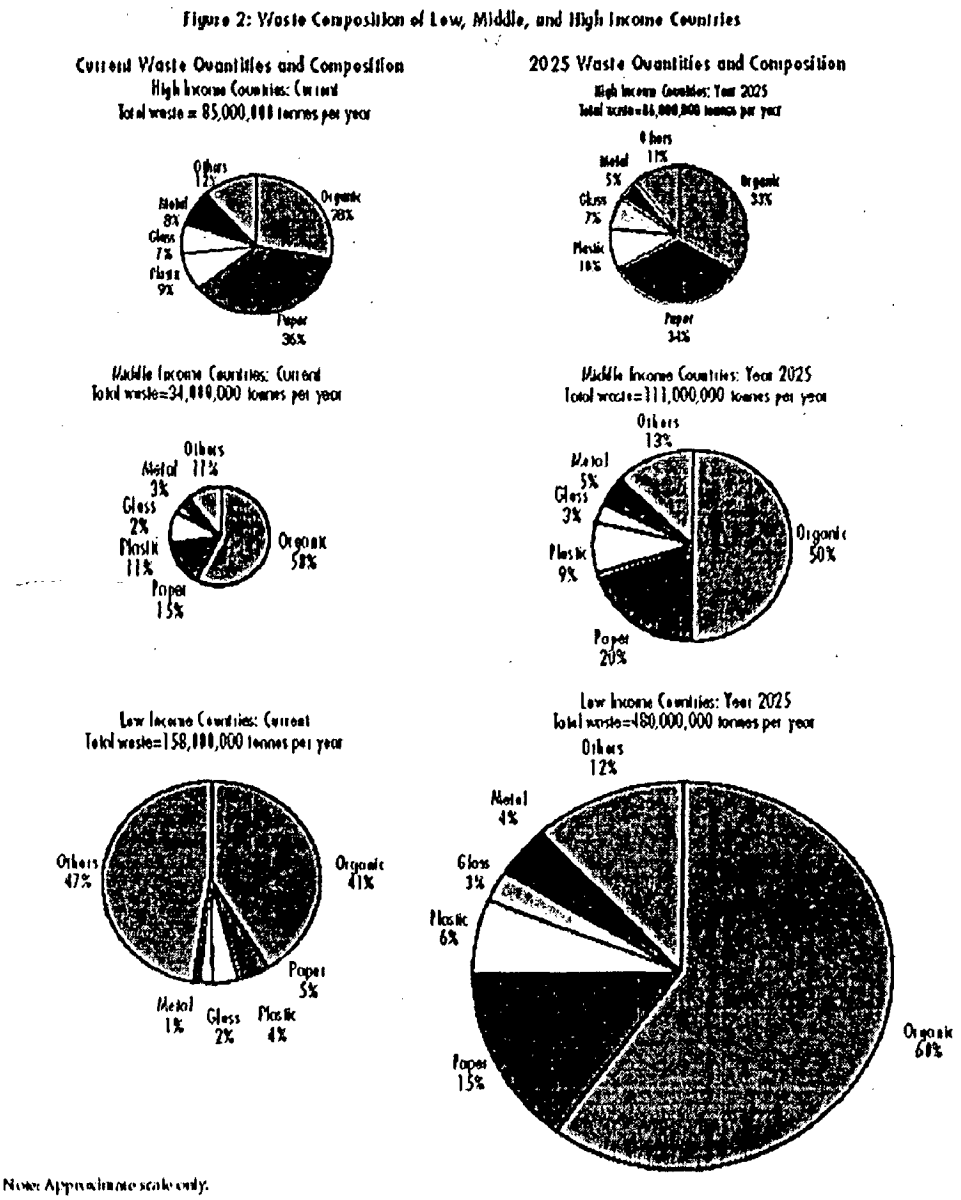
SOURCES AND TYPES OF SOLID WASTE:

This table2.1 shows the type of waste produced and their compositions produced generally in the Asian countries.

TABLE 2.1: Showing sources and types of solid waste.[1]

Sources and types of solid waste		
Source	Typical waste generators	Types of solid wastes
Residential	Single and multifamily dwelling	Food waste paper, card board, plastic, textile leather, yard waste wood ,glass, metal ,ash, special waste (bulky tem, consumer electronics, white goods, batteries oil, tires,) and house hold hazardous waste.
Industrial	Light and heavy manufacturing fabrication, construction sites, power and chemical plants.	House keeping waste packaging, food waste, construction and demolition materials, hazardous waste, ashes, special waste.
Commercial	Store hotel ,market, office building etc,	Paper card board, plastic, wood, food, waste, glass, metal, special waste.
Institutional	School, hospital, prisons, Government centers.	Same as commercial.
Construction and demolition	New construction site, road repair, renovation site, demolition of buildings.	Wood ,steel, dirt etc.
Municipal services	Street cleaning, landscaping, parks, benches, other recreational areas, water and waste water treatment plants.	Street sweeping landscaping, tree trimming; general waste from parks; benches and other recreational areas.
Process	Heavy and light manufacturing refineries, chemical plants, power plants, mineral extraction and processing.	Industrial process waste, scrap materials, off specific products, slag.

All the above waste should be treated as municipal waste		
Agriculture	Crops, orchards, vine yards dairies, feedlots forms.	Special food waste, agricultural waste, hazardous waste(e.g. plastic)



GRAPH 2.2: Shows the waste generation rates of the different countries of Asia.

COMPOSITION OF LOW MIDDLE AND HIGH INCOME COUNTRIES

The composition of waste worked out in different countries according to the composition is as following figure 2.7.

CURRENT SOLID WASTE GENETATION RATE

Asian countries and their GNP .The countries are grouped in three different categories of income groups and waste generation rates which depend on their GNP.

Table 4 shows the consumption rates different commodities like agricultural products other commodities. The consumption rate influences the MSW production.

Table 2.2 Direct and indirect per capita consumption in India. 1989-90, rupees/per annum.		
Commodities	Rural per capita consumption	Urban per capita consumption
Sugar Cane	84.34	79.34
Cotton	58.34	94.00
Coal& Lignite	33.73	81.69
Crude petroleum & natural gas.	60.34	162.03
Iron ore.	0.37	0.81
Other metallic elements.	2.23	5.23
Cement	4.08	7.88
Iron and steel.	43.15	95.48
Electricity gas and water supply.	121.53	269.69
All commodities	4996.95	9720.20
Population in millions	606.6	204.6
Percentage of population.	74.8	24.2
Parikhetal, cited in Hammond, 1998		

TABLE 2.2: SHOWING PER CAPITA CONSUMPTION.[3]

AMOUNT OF WASTE GENERATED IN THE ASIAN COUNTRIES

MacFarlane (1998) highlights a relationship between per capita solid waste management costs and per capita GNP. As shown in Figure 16, cities in both developing and industrialized countries generally do not spend more than 0.5 percent of their per capita GNP on urban waste services. The 0.5 percent GNP value can be used by low and middle income countries as a general guideline to prepare waste management budgets and for planning. These costs, however, are only about one third of the overall total. Additional costs are paid by businesses and residents, exclusive of municipal taxes and fees, (1992In Japan, municipal governments are responsible for solid waste management services and spent about 2,280 billion. In fig2.5 tables shows the comparative Statement of solid waste production in different countries of Asia. Fig 2.5 states the amount of waste generated by different countries according to the income group. Industrialized countries comprise only 16 percent of the world's population, but they currently consume approximately 75 percent of global paper production.As shown India, Indonesia, and China are three of the world's four most populous countries and among the lowest

consumers of paper per capita. However, as their GNP and urban populations grow, their paper consumption and related packaging wastes will also increase. If they follow industrialized Countries, their paper requirements will be enormous.

TABLE 2.3:GLOBAL PAPER CONSUMPTION RATES

COUNTRY	PERCAPITA PAPER CONSUMPTION (KG/YR)	PER CAPITA GNP (1995 US $)
USA	313	26980
JAPAN	225	36480
HONGKNOG	220	22990
GERMANY	190	27510
UNITED KINGDOM	170	18700
AUSTRAILIA	152	18720
SOUTH KOREA	128	9700
MALAYSIA	62	3890
CHILE	39	4160
POLAND	31	2790
RUSSIA	30	2240
THIALAND	30	2270
BRAZIL	28	3640
BULGARIA	20	1330
CHINA	17	620
EGYPT	11	780
INDONESEA	10	790
NICARAGUA	4	380
INDIA	3	340
NIGERIA	1	260
GHANA	1	390
LOO PDR	1	350
VIETNAM	1	240
DJUWENG WORLD BANK 1977b		

According to a 1992 study by the Indonesian Environmental Forum(Djuweng, 1997), Indonesian per capita paper consumption rose by 11.2 percent between 1981 and 1989.Tomeet local and international market demands and to fulfill its intention of becoming the world's largest pulp and paper producing country.

IMPACTS OF IMPROPER SOLID WASTE MANAGEMENT

Improper solid waste management causes all types of pollution: air, soil, and water. Indiscriminate contaminates surface and ground water supplies. In urban areas, solid waste clogs drains, creating stagnant water for insect breeding and floods during rainy seasons. Uncontrolled burning of wastes and improper incineration contributes significantly to urban air pollution. Greenhouse gases are generated from the decomposition of organic wastes in landfills, and untreated leachate pollutes surrounding soil and water bodies.

TABLE 2.4 :Urban per capita municipal solid waste disposal

Country	GNP per capita in 2025 (1995 US $)	2025 urban population % of total	2025 per capita MSW generation (kg/capita/per day)
Low income	1050	48.8	0.6-1.0
Nepal	360	34.3	0.6
Bangladesh	440	40.0	0.6
Myanmar	580	47.3	0.6
Vietnam	580	39.0	0.7
Magnolia	560	76.5	0.9
India	620	45.2	0.7

Low PDR	850	54.5	0.8
China	1500	45.5	0.9
Shrilanka	1,300	42.6	1.0
Middle income	3390	61.1	0.85-1.5
Indonesia	2400	60.7	1.0
Philippines	2500	60.7	1.0
Thailand	6650	39.1	1.0
Malaysia	9400	72.7	1.4
High income	41140	88.2	1.1-1.4
Korea	17600		1.4
Hongknong	3100		4.5
Singapore	36000		1.1
Japan	53500		1.3
United nations 1995			

TABLE 2.5 SHOWING CAPITA WASTE GENERTATION[4]

These negative environmental impacts are only a result of solid waste disposal; they do not include the substantial environmental degradation resulting from the extraction and processing of materials at the beginning of the product life cycle. In fact, as much as 95 percent of an item's environmental impact occurs before it is discarded as MSW. Health and safety issues also arise from improper solid waste management. Human fecal matter is commonly found in municipal waste. Insect and rodent vectors are attracted tc the waste and can spread diseases such as cholera and dengue fever. Using water polluted by solid waste for bathing, food irrigation, and drinking water can also expose individuals to disease organisms and other contaminants. U.S. Public Health Service identified 22 human diseases that are linked to improper solid waste management (Hanks, 1967. Cited in Tchobanoglous et al., 1993).

TABLE 2.5 : RESULTS OF SURVEY ASKING WHETHER PESPONDENTS FELT THAT THEIR HEALTH WAS AFFECTED BY ENVIRONMENTAL PROBLEMS [5]	
COUNTRY	PPERCENTAGE OF RESPONDENTS WHO SAID A GREAT DEAL OR A FAIR AMOUNT
INDIA	94
CHINA	93
HUNGRY	92
CHILE	88
SOUTH KOREA	88
PERU	87
POLAND	84
ITALY	83
UKRAINE	80
(ANDERSON AND SMITH)	

Waste workers and pickers in developing countries are seldom protected from direct contact and injury; and the co-disposal of hazardous and medical wastes with municipal wastes poses serious health threat. Table 2.7 shows the waste production rates according to the different to the income group of different countries .And provides a comparative study of the costs, land filling, incineration, collection, recycling and composting.

TABLE 2.6 : COMPARISION OF TYPICAL SOLID WASTE MANAGEMENT SYSTEM

ACTIVITY	LOW INCOME	MIDDLE INCOME	HIGH INCOME
SOURCES REDUCTION	No or organized programmes, but reuse and low per capita waste generation rate are common.	Some discussion of source reduction but rarely incorporated to any organized programme.	Organized education programmes are beginning to introduce sources reduction and reuse of material.
COLLECTION	Sporadic and inefficient. Service is limited to high visibility area, the wealthy and business men willing to pay	Improved collection from residential area. Large vehicle fleet and more mechanization.	Collection rate greater than 90 %.Compaction trucks and highly mechanized vehicles are common.
RECYCLING	Most recycling is through the informal sector and waste picking.	Informal sector still involved some high technology sorting and processing facilities.	Recycle material collection services and high technology sorting and processing facilities. Increasing attention towards long term markets.
COMPOSTING	Rarely taken formally even though the waste stream has high. percentage of organic contents.	Large composting plants are generally unsuccessful, small scale projects are more sustainable.	Becoming more popular at back yard and large scale facilities. Waste stream has less amount of compostible than low and middle income countries.
INCINERATION	Not common or successful because of high capital and operation cost, high percentage of moisture and high percentage of inert.	Some incinerators are used, but experiencing financial and experiencing financial and operation difficulties. Not as common as high income countries.	Prevalent in areas with high land costs .most incinerators have some form of environmental controls and some type of energy recovery system.
LANDFILL	Low –technology sites	Some controlled and	Sanitary landfills with a

LITERATURE STUDY 2

Types of solid waste[8]

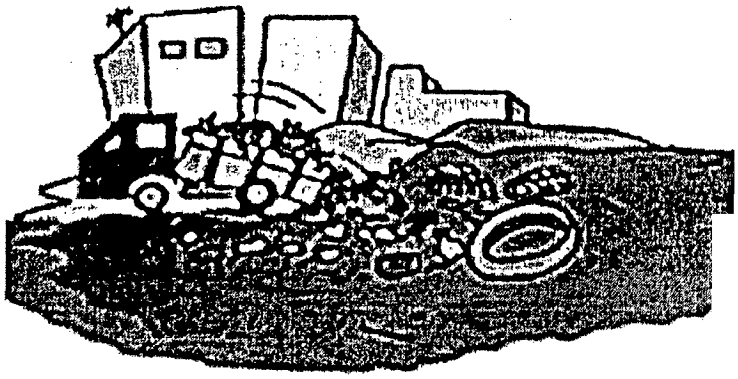
Solid waste can be classified into different types depending on their source:

a) Household waste is generally classified as municipal waste,

b) Industrial waste as hazardous waste, and

c) Biomedical waste or hospital waste as infectious waste.

Municipal solid waste



Municipal solid waste consists of household waste, construction and demolition debris, sanitation residue, and waste from streets. This garbage is generated mainly from residential and commercial complexes. With rising urbanization and change in lifesty and food habits, the amount of municipal solid waste has been increasing rapidly and its composition changing. In 1947 cities and towns in India generated an estimated 6 million tonnes of solid waste; in 1997 it was about 48 million tonnes. More than 25% of the municipal solid waste is not collected at all; 70% of the Indian cities lack adequate capacity to transport it and there are no sanitary landfills to dispose of the waste. The existing landfills are neither well equipped nor well managed and are not lined properly to protect against contamination of soil and groundwater.

Garbage: the four broad categories

Organic waste: kitchen waste, vegetables, flowers, leaves, fruits.

Toxic waste: old medicines, paints, chemicals, bulbs, spray cans, fertilizer and pesticide containers, batteries, shoe polish.

Recyclable: paper, glass, metals, plastics.

Soiled: hospital waste such as cloth soiled with blood and other body fluids.

Over the last few years, the consumer market has grown rapidly leading to products being packed in cans, aluminum foils, plastics, and other such no biodegradable items

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INCINERATION	Not common or successful because of high capital and operation cost, high percentage of moisture and high percentage of inert.	Some incinerators are used, but experiencing financial and experiencing financial and operation difficulties. Not as common as high income countries.	Prevalent in areas with high land costs .most incinerators have some form of environmental controls and some type of energy recovery system.
LANDFILL	Low –technology sites	Some controlled and	Sanitary landfills with a

	usually open dumping of waste.	sanitary land fills with some environmental controls. Open dumping is still common.	combination of liners, leachate collection systems and gas collection and treatment systems.
COSTS	Collection cost represents 80 to 90 percentage of municipal waste solid waste budget. Waste fees are regulated by some local governments but fee collection system is inefficient.	Collection cost 50 to 60 percent of municipal solid waste budget. Waste fees are regulated by some national and local governments. More innovation in fee collection.	Collection cost represents 10 % of the budget. Large allocation to intermediate waste treatment facilities.

TABLE 2.6: Showing comparison of consumption rate of different countries according to income groups.[6]

SOLID WASTE MANAGEMENT COSTS

MacFarlane (1998) highlights a relationship between per capita solid waste management costs and per capita GNP. As shown in Figure 2.8, cities in both developing and industrialized countries generally do not spend more than 0.5 percent of their per capita GNP on urban waste services. The 0.5 percent GNP value can be used by low and Middle income countries as a general guideline to prepare waste management budgets and for planning. These costs, however, are only about one third of the overall total. Additional costs are paid by businesses and residents, exclusive of municipal taxes and fees, Hoornweg (1992). In Japan, municipal governments are responsible for solid waste management services and spent about 2,280 billion.

TABLE 2.7: Showing comparison of expenditure of different countries according to income.[7]

Table 2.7 : Municipal Waste Services Expenditure				
City country	Year	Per capita expenditure on SMW (US $)	Per capita GNP (US $)	% GNP Spent on SWM
New York, USA	1991	106	22,240	0.48
Toronto Canada	1991	67	20,440	0.33
Strasbourg ,France	1995	63	24,990	0.25

Kuala Lumpur	1994	15.25	4,000	0.38
Budapest, Hungry	1995	13.80	4,130	0.33
Sao Paulo ,Brazil	1989	13.32	2,540	0.52
Tallinn, Estonia	1995	8.11	3,080	0.47
Bogotá , Colombia	1994	7.75	1,620	0.48
Caracas ,Venezuela	1989	6.67	2,450	0.27
Rigo, Latvia	1995	6	2,420	0.25
Manila , Philippines	1995	NA	1,070	0.37
Bucharest, Romania	1995	2.37	1,450	0.16
Manila , Philippines	1995	NA	1,070	0.37
Budapest , Romania	1995	2.37	1,450	0.16
Hanoi , Vienna	1994	predict	250	0.80
Madras ,India	1995	1.77	350	0.51
Lahore ,Pakistan	1985	1.77	390	0.45
Dhaka , Bangladesh	1995	1.46	270	0.54
Accro , Ghana	1994	0.66	390	0.17
MacFarlane , 1998				

LITERATURE STUDY 2

Types of solid waste[8]

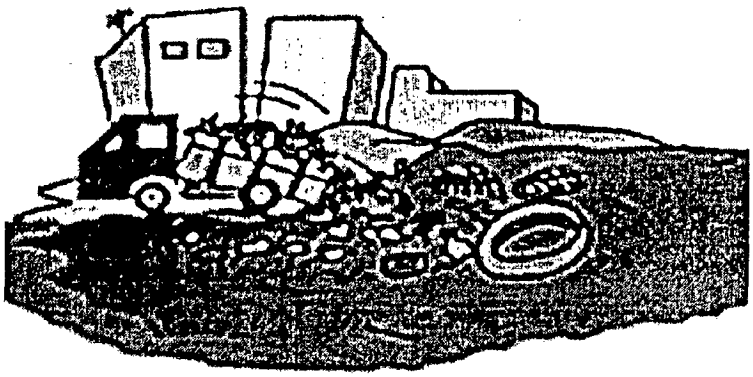
Solid waste can be classified into different types depending on their source:

a) Household waste is generally classified as municipal waste,

b) Industrial waste as hazardous waste, and

c) Biomedical waste or hospital waste as infectious waste.

Municipal solid waste



Municipal solid waste consists of household waste, construction and demolition debris, sanitation residue, and waste from streets. This garbage is generated mainly from residential and commercial complexes. With rising urbanization and change in lifestyle and food habits, the amount of municipal solid waste has been increasing rapidly and its composition changing. In 1947 cities and towns in India generated an estimated 6 million tonnes of solid waste; in 1997 it was about 48 million tonnes. More than 25% of the municipal solid waste is not collected at all; 70% of the Indian cities lack adequate capacity to transport it and there are no sanitary landfills to dispose of the waste. The existing landfills are neither well equipped nor well managed and are not lined properly to protect against contamination of soil and groundwater.

Garbage: the four broad categories

Organic waste: kitchen waste, vegetables, flowers, leaves, fruits.

Toxic waste: old medicines, paints, chemicals, bulbs, spray cans, fertilizer and pesticide containers, batteries, shoe polish.

Recyclable: paper, glass, metals, plastics.

Soiled: hospital waste such as cloth soiled with blood and other body fluids.

Over the last few years, the consumer market has grown rapidly leading to products being packed in cans, aluminum foils, plastics, and other such no biodegradable items

that cause Incalculable harm to the environment. In India, some municipal areas have banned the use of plastics and they seem to have achieved success. For example, today one will not see a single piece of plastic in the entire district of Ladakh where the local authorities imposed a ban on plastics in 1998. Other states should follow the example of this region and ban the use of items that cause harm to the environment. One positive note is that in many large cities, shops have begun packing items in reusable or biodegradable bags. Certain biodegradable items can also be composted and reused. In fact proper handling of the biodegradable waste will considerably lessen the burden of solid waste that each city has to tackle.

There are different categories of waste generated, each take their own time to degenerate (as illustrated in the table below).

Hazardous waste

Industrial and hospital waste is considered hazardous as they may contain toxic substances. Certain types of household waste are also hazardous. Hazardous wastes could be highly toxic to humans, animals, and plants; are corrosive, highly inflammable, or explosive; and react when exposed to certain things e.g. gases. India generates around 7 million tonnes of hazardous wastes every year, most of which is concentrated in four states: Andhra Pradesh, Bihar, Uttar Pradesh, and Tamil Nadu.

Household wastes that can be categorized as hazardous waste include old batteries, shoe polish, paint tins, old medicines, and medicine bottles.

Hospital waste contaminated by chemicals used in hospitals is considered hazardous. These chemicals include formaldehyde and phenols, which are used as disinfectants, and mercury, which is used in thermometers or equipment that measure blood pressure. Most hospitals in India do not have proper disposal facilities for these hazardous wastes.

In the industrial sector, the major generators of hazardous waste are the metal, chemical, paper, pesticide, dye, refining, and rubber goods industries.

Direct exposure to chemicals in hazardous waste such as mercury and cyanide can be fatal.

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- Municipal solid waste - www.epa.gov/epaoswer/non-hw/muncpl/index.htm

Segregation of municipal solid waste [9]

Municipal waste is being generated in ever increasing volumes in the urban areas. The schematic diagram describes how municipal solid waste is segregated and where it can be used. Source: CPCB Report on Management of Municipal Solid Waste.

Segregation

Certain things that are not needed around the house are kept aside to be sold to the *kabadiwala* or the man who buys old items. These items are newspapers, used bottles, magazines, carry bags, old exercise books, oilcans, etc. This is one form of segregation, which is done as a routine in all households in India. Separating our waste is essential as the amount of waste being generated today causes

immense problem. Segregation of municipal solid waste can be clearly understood by schematic representation. Certain items are not biodegradable but can be reused or recycled. In fact, it is believed that a larger portion can be recycled, a part of it can be converted to compost, and only a smaller portion of it is real waste that has no use and has to be discarded.

Household waste should be separated daily into different bags for the different categories of waste such as wet and dry waste, which should be disposed of separately. One should also keep a bin for toxic wastes such as medicines, batteries, dried paint, old bulbs, and dried shoe polish. Wet waste, which consists of leftover foodstuff, vegetable peels, etc., should be put in a compost pit and the compost could be used as manure in the garden. Dry waste consisting of cans, aluminum foils, plastics, metal, glass, and paper could be recycled. If

we do not dispose of the waste in a more systematic manner, more than 1400 sq. km of land, which is the size of the city of Delhi, would be required in the country by the year 2047 to dispose of Door-to-door collection of waste is another method of segregation, but it is not a common practice as yet in India except in the metros where some private organizations are doing such work. The rag picker plays a very important part in the segregation of waste.

It is now becoming more and more essential to look for methods by which the garbage load on the land can be reduced. It has been seen that at present segregation of waste at source level seems to be the best.

A large number of NGOs (non-governmental organizations) are working in the field of solid waste management such as Clean Ahmedabad Abhiyan in Ahmedabad, Waste-Wise in Bangalore, Mumbai Environmental Action Group in Mumbai, and Vatavaran and Srishti in Delhi. They are all successfully creating awareness among the citizens about their rights and responsibilities toward solid waste and the cleanliness of their city. These organizations promote environmental education and awareness in schools and involve communities in the management of solid waste it is now becoming more and more essential to look for methods by which the garbage load on the land can be reduced. It has been seen that at present segregation of waste at source level seems to be the best.

Segregation of waste

Waste can be segregated as

1. Biodegradable and
2. Non biodegradable.

Biodegradable wastes include organic waste, e.g. kitchen waste, vegetables, fruits, flowers, leaves from the garden, and paper.

Non biodegradable waste can be further segregated into:

a) Recyclable waste – plastics, paper, glass, metal, etc.

b) Toxic waste – old medicines, paints, chemicals, bulbs, spray cans, fertilizer and pesticide containers, batteries, shoe polish.

c) Soiled – hospital waste such as cloth soiled with blood and other body fluids.

Toxic and soiled waste must be disposed of with utmost care.

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SOURCE: TERI

LITERATURE STUDY 4

The role of the rag -picker [10]

Rag pickers are the people who are actually going through the garbage bins to pick out the 'rags'. These rag pickers, women, children, and men from the lowest rung in the society, are a common sight in most cities and towns around the country. Rag picking is considered the most menial of all activities and it is people who have no other alternative that are generally driven to it. Rag pickers contribute a great deal too waste management as they scavenge the recyclable matter thereby saving the municipality of the cost and time of collecting and transporting this to the dumps.

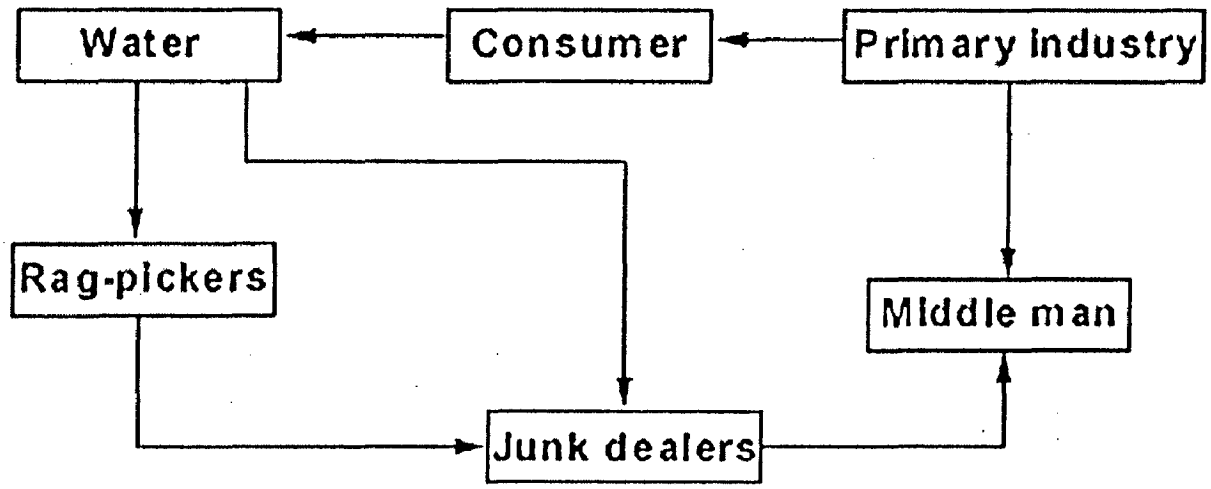
The rag picker has a special role to play in the segregation of waste in India. He is one of the focal points for the recycling of waste. He is the person who, in spite of all the dangers that he faces, goes on relentlessly picking through the garbage bin, looking for waste that could be useful to him. He sells all the material he picks to the whole sellers and retailers who in turn sell it to the industry that uses this waste matter as raw material. The main items of collection are plastics, paper, bottles, and cans.

NGOs like Vatavaran in Delhi, CEE (Centre for Environmental Education) in Bangalore and SNDT (Srimati Nathibai Damodar Thackersey) Women's University in Pune have highlighted the cause of the rag pickers and have taken initiatives to improve their lot. Although these efforts are at a local level, they are invaluable. In Bangalore, the Waste Wise project was initiated in 1990 with the aim of improving the conditions of the rag pickers and at the same time benefiting the society and the local authorities.

SEWA, *Self Employed Women's Association* in Ahmedabad has formed a rag pickers' cooperative and, over the years, has helped the women to organize themselves better and collect waste that is recyclable.

Rag pickers are well coordinated in their method of working. Among themselves, they have a good understanding for operating by area. Each group takes specific items from the bins. It has been observed that more and more women and children are getting involved in the business of rag picking. This is a matter of concern as these children who should be spending their time in schools either studying or playing are instead putting themselves at risk by handling waste. While picking through waste, the rag picker puts himself at a great risk and is always prone to disease as the waste that he rummages through can be infected.

We can indirectly help the rag picker by carefully segregating the waste that is generated at our homes, thereby facilitating his search for materials that are useful to him. He will not have to scavenge in the bins for long hours.



RECYCLING OF WASTES

FIGURE 2.4.1

- www.dep.state.pa.us/see%26hear/interactive/recy2school.htm

LITERATURE STUDY 5

Treatment and disposal of municipal waste[11]

As cities are growing in size with a rise in the population, the amount of waste generated is increasing becoming unmanageable. The local corporations have adapted different methods for the disposal of waste –open dumps, landfills, sanitary landfills, and incineration plants. One of the important methods of waste treatment is composting.

Open dumps

Open dumps refer to uncovered areas that are used to dump solid waste of all kinds. The waste is untreated, uncovered, and not segregated. It is the breeding ground for flies, rats, and other insects that spread disease. The rainwater run-off from these dumps contaminates nearby land and water thereby spreading disease. In some countries, open dumps are being phased out.

Landfills

Landfills are generally located in urban areas where a large amount of waste is generated and has to be dumped in a common place. Unlike an open dump, it is a pit that is dug in the ground. The garbage is dumped and the pit is covered thus preventing the breeding of flies and rats. At the end of each day, a layer of soil is scattered on top of it and some mechanism, usually earth-moving equipment is used to compress the garbage, which now forms a cell. Thus, every day, garbage is dumped and becomes a cell. After the landfill is full, the area is covered with a thick layer of mud and the site can thereafter be developed as a parking lot or a park.

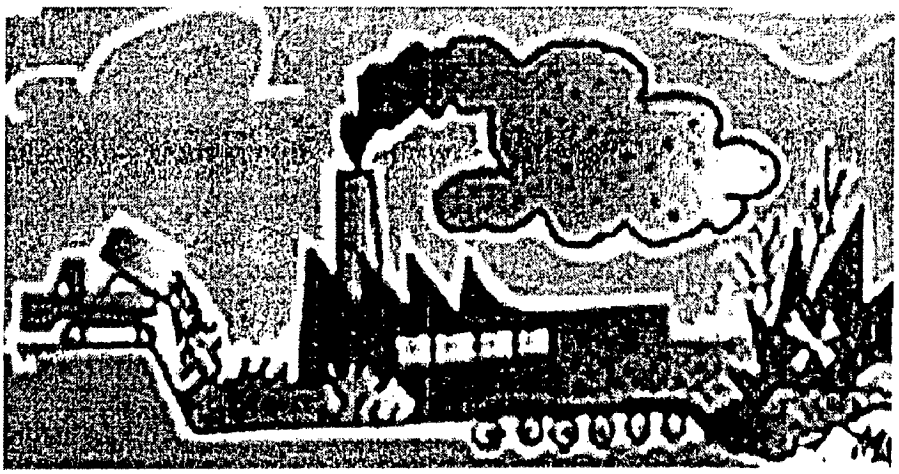
Landfills have many problems. All types of waste are dumped in landfills and when water seeps through them it gets contaminated and in turn pollutes the surrounding area. This contamination of groundwater and soil through landfills is known as leaching.

Sanitary landfills

An alternative to landfills which will solve the problem of leaching to some extent is a sanitary landfill which is more hygienic and built in a methodical manner. These are lined with materials that are impermeable such as plastics and clay, and are also built over impermeable soil. Constructing sanitary landfills is very costly and they are having their own problems. Some authorities claim that often the plastic liner develops cracks as it reacts with various chemical solvents present in the waste.

The rate of decomposition in sanitary landfills is also extremely variable. This can be due to the fact that less oxygen is available as the garbage is compressed very tightly. It has also been observed that some biodegradable materials do not decompose in a landfill. Another major problem is the development of methane gas, which occurs when little oxygen is present, i.e. during anaerobic decomposition. In some countries, the methane being produced from sanitary landfills is tapped and sold as fuel.

Incineration plants



This process of burning waste in large furnaces is known as incineration. In these plants the recyclable material is segregated and the rest of the material is burnt. At the end of the process all that is left behind is ash. During the process some of the ash floats out with the hot air. This is called fly ash. Both the fly ash and the ash that is left in the furnace after burning have high concentrations of dangerous toxins such as dioxins and heavy metals. Disposing of this ash is a problem. The ash that is buried at the landfills leaches the area and cause severe contamination.

Burning garbage is not a clean process as it produces tonnes of toxic ash and pollutes the air and water. A large amount of the waste that is burnt here can be recovered and recycled. In fact, at present, incineration is kept as the last resort and is used mainly for treating the infectious waste.

Plastics[12]

Plastic with its exclusive qualities of being light yet strong and economical, has invaded every aspect of our day-to-day life. It has many advantages: it is durable, light, easy to mould, and can be adapted to different user requirements. Once hailed as a 'wonder material', plastic is now a serious worldwide environmental and health concern, essentially due to its no biodegradable nature.

In India, the plastic industry is growing phenomenally. Plastics have use in all sectors of the economy – infrastructure, construction, agriculture, consumer goods, telecommunications, and packaging. But the good news is that along with a growth in the use, a country-wide network for collection of plastic waste through rag pickers, waste collectors and waste dealers and recycling enterprises has sprung all over the country over the last decade or so. More than 50% of the plastic waste generated in the country is recycled and used in the manufacture of various plastic products.

Conventional plastics have been associated with reproductive problems in both wildlife and humans. Studies have shown a decline in human sperm count and quality, genital abnormalities and a rise in the incidence of breast cancer. Dioxin a highly carcinogenic and toxic by-product of the manufacturing process of plastics is one of the chemicals believed to be passed on through breast milk to the nursing infant. Burning of plastics, especially PVC releases this dioxin and also furan into the atmosphere. Thus, conventional plastics, right from their manufacture to their disposal are a major problem to the environment

Plastics are so versatile in use that their impacts on the environment are extremely wide ranging. Careless disposal of plastic bags chokes drains, blocks the porosity of the soil and causes problems for groundwater recharge. Plastic disturbs the soil microbe activity, and once ingested, can kill animals. Plastic bags can also contaminate foodstuffs due to leaching of toxic dyes and transfer of pathogens. In fact, a major portion of the plastic bags i.e. approximately 60-80% of the plastic waste generated in India is collected and segregated to be recycled. The rest remains strewn on the ground, littered around in open drains, or in unmanaged garbage dumps. Though only a small percentage lies strewn it is this portion that is of concern as it causes extensive damage to the environment.

Source of generation of waste plastics	
HOUSEHOLD	Carry bags Bottles Containers Trash bags
HEALTH AND MEDICARE	Disposable syringes Glucose bottles Blood and uro bags Intravenous tubes Catheters Surgical gloves
HOTEL AND CATERING	Packaging items Mineral water bottles Plastic plates, glasses, spoons
AIR/RAIL TRAVEL	Mineral water bottles Plastic plates, glasses, spoons Plastic bags

The plastic industry in the developed world has realized the need of environmentally acceptable modes for recycling plastics wastes and has set out targets and missions. Prominent among such missions are the Plastic Waste Management Institute in Japan, the European Centre for Plastics in Environment, the Plastic Waste Management Task Force in Malaysia. Manufacturers, civic authorities, environmentalists and the public have begun to acknowledge the need for plastics to conform to certain guidelines/standards and code of conduct for its use.

Designing eco-friendly, biodegradable plastics are the need of the hour. Though partially biodegradable plastics have been developed and used, completely biodegradable plastics based on renewable starch rather than petrochemicals have only recently been developed and are in the early stages of commercialization.

Source: www.plasticsresources.com/plastics101/index.html

LITERATURE STUDY 7

Directions for GIS in Urban Planning[13]

Vivek N Patkar

Land-use planning for towns and cities in India is governed by the Town planning Act enacted by respective States. Preparation of existing land-use map, projecting future population and economic activities and accordingly prescribing the zoning pattern, transport infrastructure and reservations for public facilities and amenities along with specifications of Development Control Regulations are the essential elements of this planning process.

Manual survey to prepare the existing land-use map has been the traditional way. This very first step in formulating the Plan takes considerable time and efforts, particularly, for metropolitan cities and large towns. In the late 1980s, however, thanks to the advent of Geographic Information System (GIS) technology and Remote Sensing technology, the process of urban planning in India received a new impetus. Capturing the spatial details by remote sensing, either by satellite imageries or aerial photographs and organizing that data together with corresponding attribute data under a GIS offered tremendous ease in undertaking some of the urban planning activities outlined above.

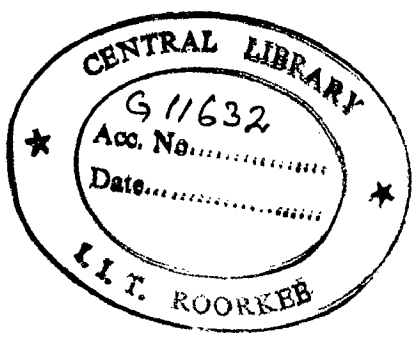
This paper advocates the strengthening and promoting the use of GIS in urban planning by overcoming the observed barriers and initiating new activities to improve the urban scene in the country. **Standardization of GIS Application** .On the basis of the experience in the use of GIS and remote sensing in urban planning the following basic activities are recommended for wider adoption:

- Preparation of existing land-use map.
- Study of urban sprawl over a given time period to understand the underlying driving forces.
- Assessment of land use conversion in different parts to help understanding of the impact of the policies pursued.
- Land suitability analysis based on physical, environmental and accessibility parameters to guide the selection process for opening the land for urban development.

- Accessibility analysis for proposed major development project like airport, growth centre and stadium.
- Evaluation of public suggestions and objections on the draft planning proposals.
- Publication of maps at various scales with relevant details.

Besides the above listed primary tasks there are many other planning tasks that can be gainfully carried out using GIS.

Comments: Info@GISdevelopment.net



PHYSICAL CHARACTERISTIC OF MUNICIPAL SOLID WASTE GENETATED BY METRO CITIES[14]

This table shows the composition of MSW produced in different cities. MSW produced in Patna has more compostable matter than Delhi. This shows the level of development. In more developed city the matter of decomposable matter goes on decreasing.

TABLE 2.8.1: Showing per capita waste generation of different cities.

Metro City	Characteristics (% by wt.)							
	Paper	Textile	Leather	Plastic	Metal	Glass	Ash, etc.	Compostable Matter
Ahmedabad	06.0	1.0	---	3.00	---	---	50.0	40.00
Bangalore	08.0	5.0	---	6.00	3.00	6.0	27.0	45.00
Bhopal	10.0	5.0	2.0	2.00	---	1.0	35.0	45.00
Bombay	10.0	3.6	0.2	2.00	---	0.2	44.0	40.00
Icutta	10.0	3.0	1.0	8.00	---	3.0	35.0	40.00
Coimbatore	05.0	9.0	---	1.00	---	---	50.0	35.00
Delhi	06.6	4.0	0.6	1.50	2.50	1.2	51.5	31.78
Hyderabad	07.0	1.7	---	1.30	---	---	50.0	40.00
Indore	05.0	2.0	---	1.00	---	---	49.0	43.00
Jaipur	06.0	2.0	---	1.00	---	2.0	47.0	42.00
Kanpur	05.0	1.0	5.0	1.50	---	---	52.5	40.00
Kochi	04.9	---	---	1.10	---	---	36.0	58.00
Lucknow	04.0	2.0	---	4.00	1.00	---	49.0	40.00
Ludhiana	03.0	5.0	---	3.00	---	---	30.0	40.00
Madras	10.0	5.0	5.0	3.00	---	---	33.0	44.00
Madurai	05.0	1.0	---	3.00	---	---	46.0	45.00
Nagpur	04.5	7.0	1.9	1.25	0.35	1.2	53.4	30.40
Patna	04.0	5.0	2.0	6.00	1.00	2.0	35.0	45.00
Pune	05.0	---	---	5.00	---	10.0	15.0	55.00
Surat	04.0	5.0	---	3.00	---	3.0	45.0	40.00
Vadodara	04.0	---	---	7.00	---	---	49.0	40.00
Varanasi	03.0	4.0	---	10.00	---	---	35.0	48.00
Vishakapatnam	03.0	2.0	---	5.00	---	5.0	50.0	35.00

Source: Central Pollution Control Board, Status of Solid Waste Management in Metro Cities India 1998

LITERATURE STUDY 9

STATUS OF MUNICIPAL SOLID WASTE GENERATION IN METRO CITIES[15]

TABLE 2.9.1: Showing capita waste generation of different cities.

Metro City	Characteristics (% by wt.)		
Metro City	Municipal Population	Municipal Solid Waste (tonnes/day)	Per Capita Generated (kg/day)
Ahmedabad	2876710	1683	0.585
Bangalore	4130288	2000	0.484
Bhopal	1062771	546	0.514
Mumbai	12288519	5355	0.436
Calcutta	10643211	3692	0.347
Coimbatore	816321	250	0.429
Delhi	8419084	4000	0.475
Hyderabad	4098734	1566	0.382
Indore	1091674	350	0.320
Jaipur	1458483	580	0.398
Kanpur	1874409	1200	0.640
Cochin	670009	347	0.518
Lucknow	1619115	1010	0.624
Ludhiana	1042740	400	0.384
Chennai	4752976	3124	0.657
Madurai	940989	370	0.393
Nagpur	1624752	443	0.273
Patna	917243	330	0.360
Pune	2244196	700	0.312
Surat	1498817	900	0.600
Vadodara	1031346	400	0.388
Varanasi	1030863	412	0.400
Visakhapatnam	752037	300	0.399
Total / Average	66885287	30058	0.449

Source: Central Pollution Control Board, Status of Solid Waste Management in Metro Cities India 1998

LITERATURE STUDY 10

SLUM POPULATION[16]

This table shows the slum population in the metropolitan cities .It shows the slum population of 81 and 91 in the urban area. in 81 the slum population of Patna was 5.83 lacks and 6.98 lacks in 91.The slum population not only contributes in the MSW production but also recycle it. This population is also engaged in rag picking which recycle the solid waste.

TABLE 2.10.1: Showing slum population of different cities

City	Slum Population (in lakhs)	
	1981	1991
Calcutta UA	30.280	@ 36.262
Greater Mumbai UA	30.831	@ 43.205
Delhi UA	18.000	22.480
Chennai UA	13.769	15.251
Hyderabad UA	5.000	08.593
Bangalore	3.650	05.162
Ahemdabad	5.172	@ 06.724
Pune UA	2.807	@ 04.065
Kanpur UA	6.140	04.172
Lucknow UA	2.850	02.778
Nagpur UA	3.890	@ 05.308
Jaipur UA	2.958	@ 04.418
Surat UA	2.347	@ 03.858
Coimbatore UA	+ 0.801	00.958
Cochin UA	2.046	@ 02.829
Vadodara UA	1.182	02.063
Indore UA	1.263	@ 01.686
Patna UA	5.837	@ 06.982
Madurai UA	+ 1.634	01.953
Bhopal UA	0.568	** 01.487
Vishakapatnam UA	1.520	02.664
Varanasi UA	2.600	02.074
Ludhiana	3.104	03.687
Total	148.249	188.659

TABLE 2.10: SHOWING SLUM POPULATION OF DIFFERENT CITIES

Note: ** Cities size as per 1991 Census Classification, @ 1981 Slum Population, + 1991 Slum Population

LITERATURE SURVEY 11

Using GIS to Improve Solid Waste Management and Recycling Programs[17]

KeithMassie

Metro Solid Waste Department, USA.

Metro is a regional government serving a population of 1.3 million in the Portland, Oregon, metropolitan region. Metro's Solid Waste Department has been a leader in incorporating GIS as a decision support tool for solid waste management. Metro's GIS has been in use for over four years and this paper will present several examples of how the GIS has been effectively used to improve the services we provide with respect to waste prevention and reduction and recycling program implementation. Case studies will include the following:

- Analyzing participation rates at Household Hazardous Waste Facilities
- Assisting haulers with routing collection vehicles
- Evaluating service levels of yard debris programs
- Developing travel time models for transfer stations
- Inventorying of multifamily complexes and recycling levels
- Calculating recycling participation rates
- Distributing compost bins and evaluating

Email: massiek@metro.or.gov

LITERATURE SURVEY 12

Caliper Announces Automated Routing Add-In for Solid Waste Collection and Other Arc-Routing Applications[18]

Paul Ricotta .USA e-mail: info@caliper.com

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NEWTON, MASSACHUSETTS - Designed primarily to support solid waste collection services, the application will generate efficient vehicle routes for solid waste collection over a street network, and can also be used for street cleaning, newspaper/postal delivery, and other applications that require an arc-routing solution with side constraints. Developed to run as an add-in to Caliper Corporation's Trans CAD transportation planning software, this program has been successfully implemented in cities around the world, and provides a user-friendly and cost-efficient solution for collection and delivery operations.

The application reduces operating costs by attempting to create routes with minimal "deadheading." Deadheading is defined as the time when the vehicle is moving but is not in service, e.g. back tracking along a street that has already been serviced to get to another part of the service network. The application also attempts to minimize undesirable or unsafe vehicle movements, such as U-turns, and lets the user specify which streets are to be serviced by a pass in each direction and which streets can be serviced in a single pass (known as the meandering problem). Furthermore, the program can also create shifts to meet driver work requirements.

Located in Newton, Massachusetts, Caliper Corporation is a leading developer of geographic information system software (GIS) for Windows. Trans CAD Transportation GIS Software is the only commercially available GIS that have been designed to support transportation applications. Trans CAD is currently used worldwide to support applications including transportation planning, facilities management, and routing and logistics.

13 GIS – MIS - GPS for solid waste management [19]

Methodology

Study of the existing infrastructure with respect to the needs, here also it represents the typical GIS problem, no proper maps (paper maps), it's not organized. One important thing, people use the maps and the database in the disorganized way. There is a feeling among the people that, they felt the need for organized system like GIS, since most of the data they use as spatially related, not only it helps in viewing and also analyzing, it will help in decision making.

- Study and analysis of the Existing Conditions-maps, attribute data, reports, the monitoring mechanism
- Creation of the baseline data and the waste quantity details
- Digitizing / demarcation of the existing health ward boundaries.
- Software up gradation to incorporate the details, to enter data (data entry-editing module), data viewing module (querying and the analyzing), MIS report & network compatible.
- Data entry of the details – spatial and attribute – bins, routes, quantity of waste dry & wet from the city level to the health ward level.
- Generation of health ward Maps with all the existing details for 277 health wards.
- Finalization of the software and integration of the three modules GIS, MIS and GPS.
- Networking and Installation of the systems in the BMP main offices and the zonal offices and creation of the monitoring center for GIS, MIS & GPS.
- Training of the officials to handle the system and updating the data.

INTRODUCTION

About one-fifth of India's total population of over 600 million lives in urban areas. Of these more than 50% live in 142 urban agglomerations and cities classified as Class I towns having populations of 100,000 and over. Among these there are 20 metropolitan centers covering a population of about 50 million.

Over many years, Indian cities and their adjoining suburban areas have suffered a low standard of service in respect of collection and disposal of house and trade wastes

and street cleansing. The present level of services in some of the more densely populated areas, like the Calcutta Metropolitan

District, is a potential threat to the community's health and environment. The general lack of resources, notwithstanding the root cause, is the lack of effort in the past to develop optimal techniques appropriate to the climate, waste characteristics, transport economics, and urban structures of the metropolitan areas and socioeconomic status and cultural habits of the people.

LOCAL GOVERNMENT STRUCTURES IN THE METROPOLITAN AREAS

In India the urban local authorities, popularly known as the municipal authorities, are classified into two major categories. The municipal corporation, headed by elected mayors, consists of three main executive authorities, i.e.

(i) The elected general council of the corporation,

(ii) The standing and financial committee, and

(iii) The commissioner who is the chief executive of corporation.

Such an institution is established under a specific state enactment for major and important cities and is bestowed with a certain degree of independence and autonomy in mobilizing resources and providing local services in the matters of public health, sanitation, water supply, sewerage/ drainage, solid waste management, roads, etc.

The other category, found in small and medium towns, is the municipal council set up under the state municipal laws, which functions under an elected chairman. The local government structures of the metropolitan urban agglomerations vary widely. The Bombay Metropolitan District, covering a population of over 8 million, is administered by a single unified local government body, the Bombay Municipal Corporation; the Delhi Metropolitan District is governed by three different local government agencies and the Calcutta Metropolitan District, with a population of over 9 million, has the most complex local government structure with 2 municipal corporations, 33 municipal councils, 37 non-municipal urban centers, and 544 rural units. In general, in most metropolitan centers the city proper is under a municipal corporation and the suburban and fringe towns are under municipal councils.

QUANTUM OF URBAN SOLID WASTES

The quantity of solid wastes generated per person per day in the urban areas in India has been variously reported to be between 300 and 600 g. The quantity, which

includes household garbage and rubbish, trade and industrial refuse, street sweeping, construction and demolition debris, sanitation residues, etc., varies according to the socioeconomic and cultural habits of the people, urban structure, density of population, and degree of salvaging at source. In the most densely populated metropolitan cities of Calcutta and Bombay, solid waste generation rates are more than 500 g/capita/day, whereas in Delhi, which has a higher level of per capita income, but much lower density of population generation, it is 300 g/capita/day. Most of these reported figures are based on quantity collected by the municipal authorities, rather than what is actually being generated.

In the opinion of the present author, the quantity of combined city refuse reaching municipal collection systems at the present level of development would not be more than 400 g/capita/day in areas with a density of population less than 20,000/km2. The same figure would be between 500 and 600 g/capita/day in the more densely populated areas. In unsewered areas the quantity may be higher due to the presence of surface drain sludge. For future planning, an average annual growth rate of 1% should be considered.

On this basis, the nine major metropolitan centers in India are presently producing 8.5 million t of solid waste per annum, which would reach 12 million t/annum by the turn of this century.

1. **Table 1 collection of urban slid waste in some Indian cities and towns**

Sl no	Name of municipality	population	Density of population	Total quantity collected per day tones	Per capita collection per day kg
1	Delhi	5500000	23000	1600-1800	0 .3
2	Calcutta	3300000	32000	1600-1800	0 .5
3	Howrah	670000	25000	320	0 .5
4	Kanpur	1300000	-	700	0 .55
5	Bangalore	2000000	-	1000-1100	0 .55

Few local authorities in India carry out a regular analysis of the refuse collected, and therefore authentic information regarding the composition of urban solid waste in different cities is not available. These are based on studies by various research institutes.

Wide variations in the composition of refuse from different cities are noticed which may be due to varying socioeconomic and cultural circumstances and climatic conditions. Generally speaking, refuse from Indian cities contains a high compostable and low combustible matter. The quantity of ash and earth is also high, particularly in suburban and fringe area of the metropolitan districts. This may be due to the presence of surface drain sludge and silts. This also explains the higher density of refuse in these places; paper, plastics, metals, etc. are present in very low quantities because of intensive private scavenging by the urban poor. The calorific value of urban solid waste is low; less than 1,500kcal/kg. In most cities, and the average density of refuse varies between 500 ~ 600 kg/m^3.

PRESENT STATUS OF STORAGE, COLLECTION, TRANSPORTATION, AND DISPOSAL OF URBAN SOLID WASTES IN THE METROPOLITAN CITIES AND SUBURBAN AREAS COLLECTION AND TRANSPORTATION

In most municipal towns in India, the municipal service for the collection and transportation of urban solid wastes can be considered as three separate functions.

(a) Sweeping and curbside collection.

(b) by hand-carts to large on-road collection points, which may be open dumps, vats, (masonry enclosures) or storage chambers; and

(c) Transportation by vehicles to the disposal sites. Collection from individual houses is not generally practiced. In the city areas the collection is done once or twice a day, but in the rest of the metropolitan district collection is irregular.

In terms of the proportion of solid wastes generated which are collected daily and disposed of by municipal workers, the city corporations of Delhi, Calcutta, Bombay, Madras, and other big cities are about 90% efficient. But in many of the smaller municipal towns and non-municipal areas, within the metropolitan districts, 60-80% of waste is never collected. The average per capita collection in most of the suburban and fringe municipal towns within the Calcutta Metropolitan District is about 200 g/day. The same figure for most of the city corporation areas in India is between 400 and 500 g/per capita/day or more.

Some of the big city corporations, like Delhi and Calcutta, are using mechanically operated front-end loaders in some places. However, at the present level of

relative cost for labour and machine in India, large-scale use of such mechanical loaders would not be cost effective.

Vehicles with hydraulic compactors have also been tried in some cities. But compactors, as designed in Western countries, would not be an ideal choice for I. Indian City refuse, which has a high density of about 600 kgm^3. There is a lack of servicing and workshop facilities. The efficiency of the Transport fleet depends considerably upon its timely servicing and proper maintenance. Most municipal bodies in India have not been able to develop adequate workshop facilities of their own.

Resulted in under utilization of the fleet capacity due to delay in repairs and resulted in under utilization of the fleet capacity due to delay in repairs and consequent non-removal of garbage from many parts of the city.

2. DISPOSAL OF URBAN SOLID WASTE

More than 90% of urban solid waste in Indian cities and towns is disposed of by land filling, and only a minor fraction, about 10%, is composted for producing organic manure and soil conditioner. The present status of land filling and composting in the metropolitan city centers is discussed in the next two.

3. CHAPTERS.

Indian city refuse, having a low calorific value, high moisture content, and a high quantity of non-combustibles, is not generally suitable for incineration (Figure 1). Apart from a high initial cost, it would need a large quantity of auxiliary fuel. At the present market values in India, the relative cost of refuse disposal by sanitary land filling, manual composting, mechanical composting, and incineration would be in the range of 1: 2.5 : 5 :25 Presently, none of the municipal corporations in India is running a full-scale incineration plant.

An incineration plant of 120 t/day capacity was commissioned in the city of Calcutta in 1939. It ran for only six months, and has been out of operation since then. When it is considered that current total expenditure on solid waste management, including collection of wastes and street cleansing, ranges between Rs 6/- ($0.7) and Rs 25/- ($3.0) per person per year, incineration is ruled out simply on the ground that it would more than double the annual budget requirement. In terms of both cost and environmental protection, sanitary land filling and composting appear to be the two most suitable methods of disposal for Indian cities and towns.

LANDFILLING

Major portions of the solid wastes collected by the municipal authorities in the metropolitan cities are presently disposed of by dumping in land or water.

Waste in four major disposal grounds. All the sites have good approach roads, and average haulage is within 15 km. They all have the necessary facilities for weighing, mechanical handling of refuse and earth, watering and washing, etc. The areas filled up with refuse are regularly covered with fresh earth, and other precautions, like spraying of insecticides for fly control, are also taken.

Disposal sites, so filled, are being developed into parks and woodlands. The average cost of disposal of garbage by this method works out to be about Rs 10/- 1 ($1.2) per tonne. ; Bombay Municipal Corporation, which covers a population of more than 7 million and collects more than 2,500 tones of solid wastes a day, disposes of more than 90% of them by controlled tipping in low-lying areas adjacent to the sea for land reclamation. The operational controls and sanitary precautions practiced by them are fairly satisfactory. In the remaining metropolitan areas, major portions of urban solid wastes are disposed of by uncontrolled dumping on municipal land. In the smaller municipal towns and non-municipal urban areas, within the metropolitan districts, private land filling and uncontrolled tipping into water courses are also practiced.

In the Calcutta Metropolitan District, covering a population of 9 million people, there are more than 40 disposal grounds apart from many private land filling sites, the largest of them receiving more than 500 tones of refuse per day and the smallest less than 10 tons per day. Average haulage for various sites also varies widely between 1.5 to 20 km.

An acute shortage of land for refuse disposal in the smaller municipalities within Calcutta Metropolitan District has compelled many of them to throw refuse indiscriminately on to private lands. The Calcutta Corporation possesses about 2.3 hectares of land per 10,000 people, whereas the suburban municipalities, on an average, possess only 0.33 hectares/10,000 people.

COMPOSTING OF URBAN SOLID WASTE

The physical and chemical characteristics of Indian city refuse show that 40-60% of it is compost able and that it has adequate nutrients (NPK), moisture content of 40-50%, and a carbon-to-nitrogen ratio of 25:1 to 40:1. Hence, composting of city garbage can produce good quality organic manure and soil conditioner at a cost which is much

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lower than that of artificial fertilizers. Considering the scope, need, value, and importance of the conversion of city refuse into organic manure, in the interest of both agriculture and sanitation, the Indian Ministry of Agriculture is subsidizing the city compost plants and assisting them in the management and maintenance of plant as well as marketing their products. At the moment in India, two methods of composting are practiced by different municipal organizations:

(a) Pre-treatment or post-treatment windrowing (mechanical/semi-mechanical/manual): larger city corporations; and

(b) The Indore or Bangalore method of composting of refuse with night -soil in masonry pits or earth-trenches: small and medium municipalities.

Pre-treatment or post-treatment windrowing

During the last decade, mechanical compost plants of the above type have been constructed in 25 cities, which now treat 10-20% of urban solid wastes in most of the important cities in the country. Aeration systems in the city of Baroda. Careful study of the Indian situation reveals the following points.

(a) The design of the various mechanical components of the pre-treatment or post-treatment plants is yet to be standardized, and there is a diseconomy of scale, the unit cost of compost production rising with plant capacity and degree of mechanization. This could be attributed to inappropriate technology and unnecessary mechanization. The advantages of mechanization should be made use of, but turnkey projects of patented process developed for Western conditions requiring a high degree of skill for operation and maintenance, as have been done for many of the present plants in India, would be counter-productive.

(b) Costly pre-treatment units like hammer mills, magnetic separators, underground aeration systems, etc. may not generally be required for Indian refuse, which comes mostly in sizes less than 2in. and contains negligible amount of ferrous metals.

(c) Manually operated windrow plants would be cost effective up to 30 t/day capacity, i.e. for a population of 60,000. At this level the transportation cost of refuse and compost would also be minimal. Hence, composting could be an ideal disposal method for small and medium suburban towns at close proximity to the agricultural hinterland.

(d) For plants receiving 100 t or more, some mechanization would be necessary for handling and turning the windrows and post-treatment.

(e) Finished compost produced from Indian city refuse would contain about 20 kg of nutrient (NPK) value. At the current market conditions, it would be worth Rs 100/-

($12.0). A semi-mechanical compost plant, with minimum mechanization for handling and turning of windrows and post-treatment, would be able to produce it at Rs 50/- ($6.00) per ton. But the paradox of the Indian situation is that unnecessary and avoidable mechanization have pushed the production cost to Rs 80/- to Rs 90/- per ton and, in the absence of adequate sales promotion efforts, most of the city corporations are finding it difficult to sell their product at that price. The Ahemdabad plant produced about 4,500 t of compost in 1975-76, out of which it could sell only about 36 tons at Rs 70/- per ton. Since there were no further off-take at this price, the price was subsequently reduced to Rs 45/- and then to Rs 25/- per ton, the net loss being about Rs 10000, 000/- per annum on average. Experience of other city corporations is not much different. Inadequate planning, inappropriate technology, and poor management is holding up the progress of a basically sound programme. However, one should not lose track of the fact that even at the present level of production cost and market price, the net disposal cost of urban solid waste through composting varies between Rs 10/- and Rs 20/- per tonne, which is marginally higher than the cost of sanitary land filling by the Delhi Municipal Corporation and almost comparable to the cost of crude dumping carried out by the Calcutta Corporation.

INDORE/ BANGALORE METHODS

The Indore process involves aerobic-cum-anaerobic decomposition of refuse and night-soil in shallow open masonry pits (10ft x 100ft x 2ft). The material is turned every 2 weeks for a period of 8 weeks and then matured for 4 weeks. In the Bangalore method anaerobic composting of refuse and night-soil is done for a period of 4-6 months in a shallow earth trench.

Most of the small and medium towns in India, with a large number of service privies, are practicing this method of composting night-soil with solid wastes. However, only a minor fraction of the municipal refuse would be disposed of in this manner. The operations are carried out without any skilled supervision and the conditions in the disposal sites often create serious problems of environmental pollution. The sale price of compost produced by this method varies from as low as Rs 0.50/- to Rs 35/- ($4.00) per tonne. In a survey conducted by the Ministry of Works and Housing it was found that in 36% of the class I towns composting by this method is self-financing. However, with the elimination of service privies from the municipal towns, this process of

ORGANIZATION AND PLANNING ASPECTS

As stated above, except in the case of Bombay where the entire metropolitan district of greater Bombay is under the jurisdiction of Bombay Municipal Corporation, there are many local government organizations of varying size/; and populations within a metropolitan district.

In the matter of organizational and financial resources the suburban and fringe municipalities are much weaker compared to the city corporations. This imbalance is also reflected in the quantity of services rendered by them in their respective areas. The institutional capacities and financial resources of the larger city corporations like Calcutta, Bombay, Delhi, and Madras are reasonably good and they have an adequately large technical man power, vehicular fleet, and labors force. Conservancy departments in larger city corporations, responsible for solid waste management and public cleansing services, are headed by civil or mechanical engineers, designated as director of conservancy or chief engineer.

The larger city corporations have 4 to 6 staff per 1,000 population and the suburban municipalities have only 2/3 staff per 1,000 population for solid waste management. The city corporations of Delhi, Bombay, Calcutta, etc. spend about Rs 20/- to Rs 25/- ($2.5 to $3) per annum per person on solid waste management services, whereas the suburban municipalities spend, on an average, only Rs 6/- ($0.75) per annum per person on the same. In the Calcutta Metropolitan District 60% of the total annual expenditure on solid waste management is enjoyed by 30% of the population living in the city corporation area. The smaller municipalities' institutional and financial resources are too inadequate for effective management of their available resources. A survey in the municipal towns in the Calcutta Metropolitan I District has shown that the unit cost of collection, transportation, and disposal, has increased with a decrease in per capita spending. This indicates that the available resources have not been put to their optimum use in these municipalities.

In a metropolitan district like Calcutta, with multiple local bodies, an integrated and regional approach is necessary for the development of an optimal solid waste management system for the entire metropolitan area. Optimum utilization of available resources is not possible if so many agencies are to work within their artificial boundaries and varying financial resources. An integrated and regional approach is essential for planning trans-municipal disposal facilities. The locations of present disposal grounds and their sizes have not been decided on the basis of optimum haulage and a rational

transportation routing. At no stage in the past have attempts been made to optimize the transportation system by relocating disposal sites on a regional basis or introducing transfer facilities. The present system is the cumulative effect of ad hoc planning by a number of local government agencies working within the limitations of their artificial boundaries.

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CHAPTER.3

3.1Minimization of waste by process design

Waste is the ever-present curse of modern civilization. Its creation in waste volumes seems inevitable and, once created, it must be disposed of safely. But is it inevitable? It is very true the, if there in no waste, there is no problem with waste. Our subject is waste management, but the best management approach is to manage affairs so that there is no waste to manage. That is to manage affairs so that there is no waste to manage. That is of coerce an impossible dream, but the proper management of waste being produced be minimized, if not totally eliminated? The production of can waste can be drastically reduced in many instances. There are two main methods of approach to initial waste reduction: designing plants so that less waste is produced; and reusing or recycling such waste that is produced. Typical of these was an international seminars and conferences waste minimization was to the fore.[1] Whilst it was felt that much remains to be done with respect to waste treatment, by seeking out more efficient and cost-effective methods, yet a more direct approach was through waste minimization. The change in emphasis over the past 15 years was highlighted thus:

	Predominant Method
Fifteen years ago:	safe Landfills
Five years ago:	safe treatment
Today:	Waste minimization

Waste reduction is the way

Unfortunately, all the regulations relating to waste seem to be based relating to waste seem to be based on the premise that waste in unavoidable. There are no regulations prohibiting in any way the initial production of waste only regulations stating what is to happen to it once the problem has been created: a more fundamental issue is that attempts should be made and encouraged to reduce that volume of waste that has to be disposed of. There is no doubt that efforts to reduce and minimize waste can bring substantial dividends: not only is there a substantial financial inducement, but there are also other benefits that cannot be disposed of. There is no doubt that efforts to reduce and minimize waste can bring substantial dividends: not only is there a substantial financial inducement, but there are also other benefits that can not be evaluated in direct monetary

terms. For example, the 'image' of a company and its public relations will both improve. Furthermore, if, for instance, the volume of waste produced was halved, the problems associated with its disposal would be more than halved.

3.2 WASTE IS GENERATED AT THE DRAWING BOARD

Prevention is always better than cure, so that when plants are being built, waste creation-or better, waste elimination-should be considered before waste treatment and disposal. This may well mean seeking an alternative process, an approach that may be time-consuming, but ultimately very rewarding. The problem must be attacked at its root and this could lead to its disappearing it.

Substitute 'waste prevention' for 'safety' and the advice is pertinent to or present subject. Engineers-to-be should be brought to realize that they, personally, are responsible for the outcome of their work and its proper functioning. However incidental and minor their work may appear to be, they may well have the lives of people, perhaps many people, in their hands. Waste elimination has an importance in this context equal to plant safety, especially when the waste happens to be hazardous or toxic.

There are meaningful ways of waste reduction. A waste by-product can be reintroduced as raw materials; production processes and operation can be changed; raw materials can be substituted; products can be reformulated; inventories of dangerous materials can be minimized.

Given the way in which companies are currently organized to deal with environment problems, and the manner in which economic analysis is applied when evaluating alternatives, there is an in-built bias against waste reduction.

3.3 THE ROLE OF WASTE MINIMIZATION

What is the difference between waste minimization and waste reduction? To have waste reduction as an objective is to seek to reduce the volume of waste produced. A realistic and serious waste reduction programme must start with a step-by-step waste audit and the compilation of the waste reduction possibilities. These are ranked in order that the optimum option may be selected. An extremely useful checklist has been provided in this context by Formm.[14] the success of such a programme can be evaluated

in terms of quantity of waste generated per unit of production, and the audit team must have a good understanding of the process and full cooperation from the plant operators.

Non-waste technology is exactly that: no waste at all is generated. It is an issue of worldwide importance and has been regarded as significant enough to merit being defined by the United Nations Economic Commission for Europe thus:

The practical application of knowledge, method and means, so as-within the needs of man- to provide the most rational use of natural resources and energy, and to protect the environment.[1]

It is still usually uneconomic. As we survey present trends, we see the development of a non-waste technology to be an imperative. The three key factors leading to this conclusion are

1. Raw material resources are finite and are rapidly depleted.
2. There is an energy crisis in terms both of availability and price.
3. There is serious environmental pollution.

Which we need non-waste technology. How should non-waste technology impact on the three key factors just mentioned above?[2]

- Materials: products should be designed for long life and conservation.
- Energy: every means should be adopted to avoid loss (e.g. by insulation) and to increase efficiency.

Pollution: use non-polluting processes, and recycle where waste is unavoidable.

3.4 A NON-WASTE VALUE SYSTEM

Waste is enormously wasteful. It leads not only to pollution today, but to material shortages tomorrow. The age-old saying 'waste not, want not' is as valid in the affluent 'effluent society' of today as it ever was. The very existence of society as we now know it is threatened by the continuing waste of precious, scarce resources. If the present industrialized society is to survive, it must become a non-waste society with a non-waste economy using non-waste technology, and above all a non-waste value system.

A kilogram of animal protein takes ten times as much energy to produce as dose a kilogram of vegetable protein.

- Air transport requires at least a hundred times as much energy as water transport per passenger or tonne kilometer.
- Per passenger kilometer a car requires 30 times the energy of a bicycle.

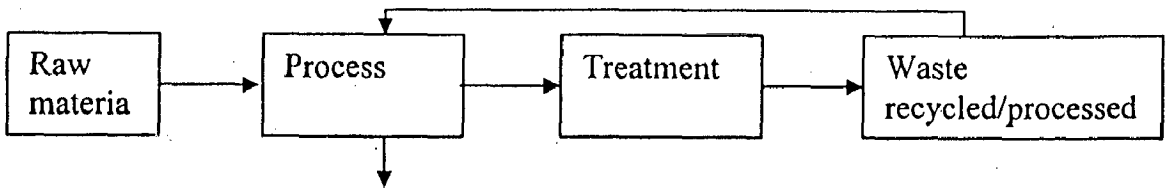


FIG.3.1: Zero waste technology.

The recycling of waste, whatever it's from, is very sound approach to a mounting problem. The immediate and most direct answer to the problem of the growing mountain of waste is to recover and recycle to the maximum extent possible. Many basic materials, such as metals. Paper, and glass, can be separated out and recycled to the advantage of us all. At the same time the natural raw materials – mineral ores, timber and limestone respectively – are being conserved.[1]The volume of plastics had increased sub-statically, largely at the expense of the wastepaper and glass. Industrialized countries can be expected too show a very similar pattern in relation to their domestic waste. Recycled materials are used for the manufacture of cans, bottles paper and the like. Solid residual can be used to generate energy in the from of steam, gas or electricity an –aspect discussed earlier. The recycling of metals, in particular, can lead to enormous savings in energy as compared with the initial manufacture. Both air and water pollution will be reduced by recycling, and less water will be used.

There are profits to be made from waste recycling. Whilst the re-use of waste has been promoted as good economic sense for the public, it can also good business for those who engage in it. The ever-increasing cost of waste disposal and the fact that there are profits to be made from recycling have fuelled the current boom.

TABLE 3.1 Reductions Achieved (0%)

	Aluminum	Steel	Paper	Glass
Energy use	90-97	47-74	23-74	4-32
Air pollution	95	85	74	20
Water pollution	97	76	35	-
Water use	-	40	8	50

Paper recycling has been encouraged by promoting the motto; recycle your paper, save a tree. The disposal of old tyres has posed a serious problem for many years. Now they are being ground up to from 'crumb rubber' which can then be used in rubber result in a better more durable product than does virgin rubber recycling becomes attractive as the cost of waste disposal by other means rises. Whilst it is profitable it will be pursued. It minimizes the damage that waste dose to our health and the environment, but that will never happen. The good environment could well always prevail.

There is every possibility that at least half of the domestic waste currently being generated could be recycled. The potential is there, but to achieve such a degree of recycling requires considerable planning and intensive effort. Paper, for example, will lose its value rapidly when mixed with organic food waste. Glass and metals are less vulnerable to degradation in this way, but they still need to be segregated. Organic waste, if destined for composting, must be free of inorganic waste, if destined for composting must be free of inorganic substances toxic to plant life. In general, the nearer the recovery process it to the sources of the waste the less sorting and processing will be required before.

Table3.2 The use being made of recycling in some of the major industrial countries

Table 3.2.	Percentage Recycled (in 1985)		
	Aluminum	Paper	Glass
United States	28	27	10
United Kingdom	23	29	12
Japan	32	48	-
The Netherlands	40	46	53
West Germany	34	40	39

In considering the impact of recycling, the most significant aspect is the reduction in the demand for the basic raw materials and the reduction in pollution from the manufacturing process. For instance, the recycling of a tonne of aluminum apart from the enormous saving in electrical energy eliminates the need for four tones of bauxite and 700 kg of petroleum coke, whilst the emission of the air-polluting aluminum fluoride is reduced by some 35kg. Paper is another case. Where the impact of recycling on the environment could be quite dramatic.

Recycling paper not only spares millions of hectares of trees from felling, but also conserves energy and reduces water pollution. If only half of the paper used in the world today were recycled that would not only meet a substantial part of the demand for newspaper but also preserve nearly 8 million hectares of forest land. There are many plastic products that can be modified to make them degradable and this is obviously a very desirable and this is obviously a very desirable approach. There is a new potential for degradable plastics in the light of the growing impact of environmental factors and coming world wide legislation which is likely to present obstacle to the future growth of the plastic industry.

**requires lower government subsidy than other such as landfill or incineration. In fact recycling deserves maximum subsidies, since everyone will gain.

3.5 EFFORT IN DEVELOPING COUNTRIES

Effort in this direction is not so well organized in the developing countries.

As imposing a heavy fee on landfill of incineration, will also encourage recycling. Can markets for recycling e mandated?[3]

Recycling can make a very substantial contribution towards minimizing the volumes of waste that have to be disposed of everyone seems convinced that recycling is the way to solve the problem associated with waste disposal.

Countries such a West Germany, The Netherlands and Japan, who do not have an abundance of raw materials and are also limited for space, have used recycling for many years. Most if the recycling takes place with municipal waste with more than 50 per cent of such waste being recycled. Waste once deposited is normally the legal property of the municipality, but exemptions to this rule have been made to facilitate recycling. For instance, a day is nominated for surplus or unwanted furniture and other household goods to be placed at the roadside, and anyone is at liberty to remove such items for their own use before the council cleaners come along. The main factor is the order to win their cooperation. It is recognized that what may be waste and not wanted by one may be riches for another. This is almost always the case as we have found by personal experience. One of us picked up a discarded portable typewriter in the United States in this manner took it home and had it serviced. It is still in excellent condition after five years further use.

3.6 RECYCLING PLASTIC

One of the biggest obstacles to the recycling of plastic waste has been that the various type of plastic waste cannot be mixed the one another: the chemical reactions that ensue cause too many processing difficulties. However, techniques have now been developed whereby incompatible plastic can be blended and still turned in to useful products. A Belgian company, advanced Recycling Technology, has developed an extruder which will blend a range of plastic materials such as polyvinyl chloride (PVC), polyethylene terphthalate (PET) and polystyrene (PS). The mix can than be formed in to stable modeled products.[13] Over a dozen such plant based on this extruder technology are currently in use across Europe and in the United States. The extruder melts the mixture of plastics together, and this can then be modeled as appropriate. The product has wood-like properties; it can be nailed, screwed into, cut and planed with standard woodworking

equipment. It is indeed better than wood in many applications, since it water-resistant, rot-and bacteria-proof, and resistant to salt water and chemicals. Indeed, the very properties which make it so difficult to dispose of are of grate value in re-use. The material will not splinter or split, withstands freezing and thawing and can absorb shocks. One use has been in the manufacture of fencing posts, and it seems that posts placed in the ground five years ago have remained upright and rot-free, requiring no maintenance.

References.

This chapter has been adopted from Waste management, Towards a sustainable society, O.P.Kharbanda and E.A.Stallworthy.

1. UNECE proceedings: non waste technology and production, Pergamon press, 1978.
2. Kharbanda, O.P., *Need –waste technology*, chemical industry news, September 1982,
3. UNCEC proceedings; op cit.

CHAPTER.4

CASE STUDY

4.1. - NEW DELHI[1.]

4.1.1GENERAL INFORMATION ABOUT THE CITY

DELHI Capital of India situated in the North of India, 160km south of the Himalayas.

Area 1483 km.^{2}

Population 138 Lacks (2001) Population density 9305 persons/km$^{2.}$

4.1.2MATERIAL CYCLE

Every material (matter/energy) is recycled in Nature based on the two Laws of Thermodynamics:

First Law of Thermodynamics:

Energy/Matter is transferred from one form to another form but is never be created or destroyed.

- **Second Law of Thermodynamics:**

No processes involving an energy/matter transformation occur unless there is a degradation of energy from a concentrated form into a dispersed form.

HOUSEHOLD MATERIAL CYCLE

Household waste (matter) cycle comprises of **Solid waste** and **Liquid waste.**

Composition of Household Solid-waste

The composition of Garbage in a House contains 25-30% of recyclable material and is about 70-75% compostible material.

Description	**Percentage by weight**
Vegetable leaves	50.0%
Grass	1.0%
Paper	10.0%
Plastic	5.0%
Glass/ceramics	2.0%
Metal	2.0%
Stones/ashes	15.0%

Miscellaneous	15.0%

4.1.3 Composition of Municipal Solid waste at city level.

Municipal Solid Waste generation 6,000TPD 0.475Kg/day/person.

The composition of Garbage in city indicates lower organic matter and high ash or dust contents. It has been estimated that recyclable content in solid waste varies from 13 to 20% and compostible material is about 80-85%.

A typical composition of municipal solid waste is given below:

Description	Percentage by weight
Vegetable leaves	40.15%
Grass	3.80%
Paper	0.81%
Plastic	0.62%
Glass/ceramics	0.44%
Metal	0.64%
Stones/ashes	41.81%
Miscellaneous	11.73%

4.1.4 Cycle of Household Solid Waste:

It comprises of Collection, Transportation and Disposal (CTD).

- **Collection**

Major saleable portion is segregated at house level itself, than remaining saleable material is collected by the Rag pickers at various levels of Transportation.

- **Transportation**

Waste at first level is collected by the sweepers and they stored the waste at Dustbins or Dhalaos. From there waste is carried over by the Trucks at Disposable sites.

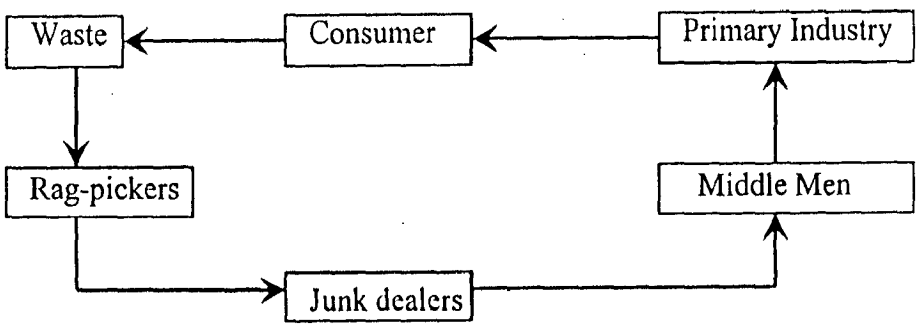
- **Disposal**

Waste is disposed at Landfills.

FIG 4.1 **Cycle of Decomposable waste**

When Landfills are full, the sites are used for planting the Trees.

FIG 4.2 **Cycle of Recyclable waste**



4.1.5 Steps involved in the process prior to recycling include:

1. Collection of waste at door steps, commercial places and from other placements.
2. Collection of waste from community dumps.
3. Collection/Picking up of wastes from final disposal sites.

Survey reveals that about 15 to 20% of the waste is recycled. The various types of waste and their cycles are discussed below to produce different products.

PLASTICS WASTE

FIG 4.3 **Polythene**

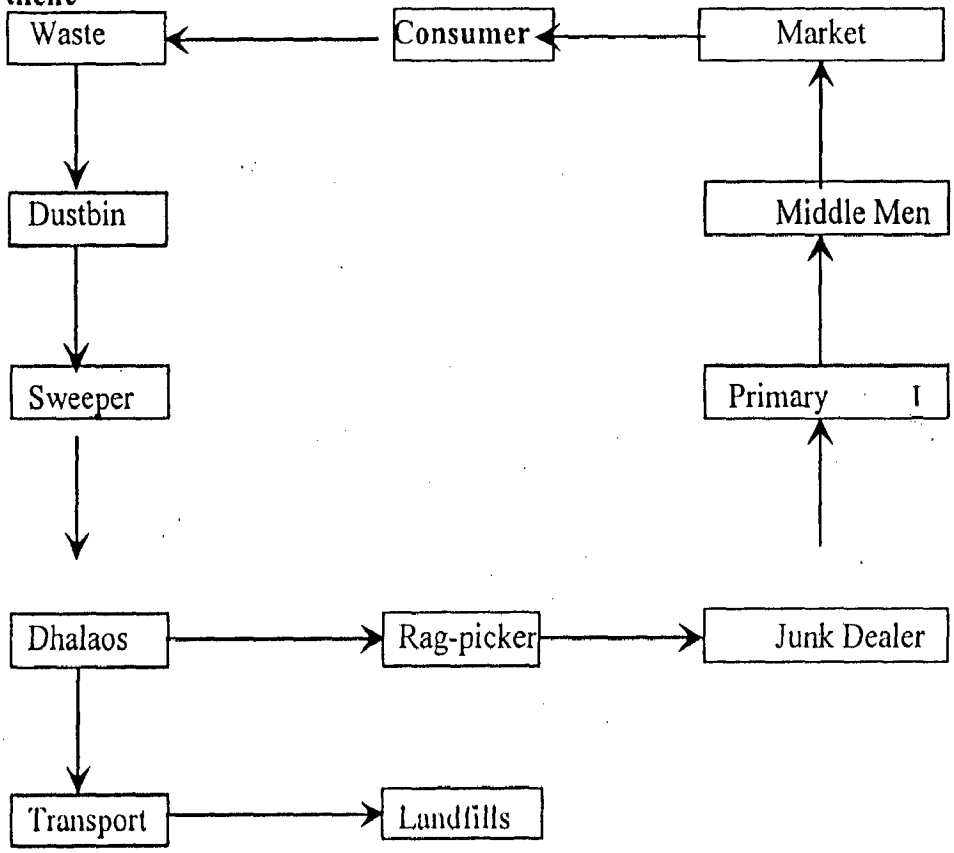
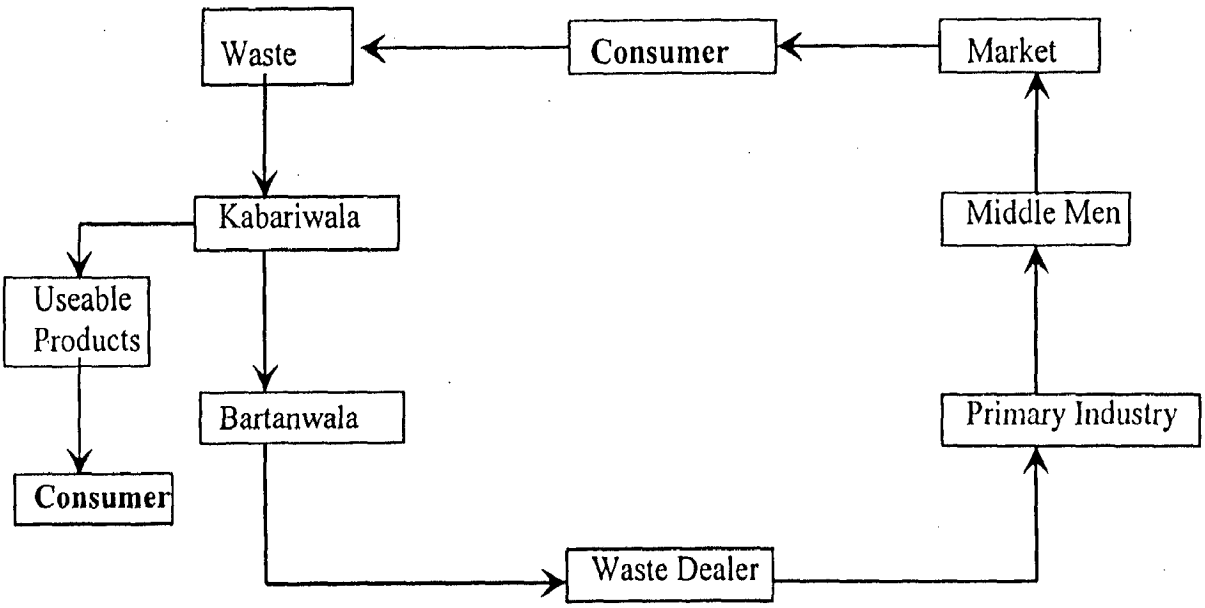
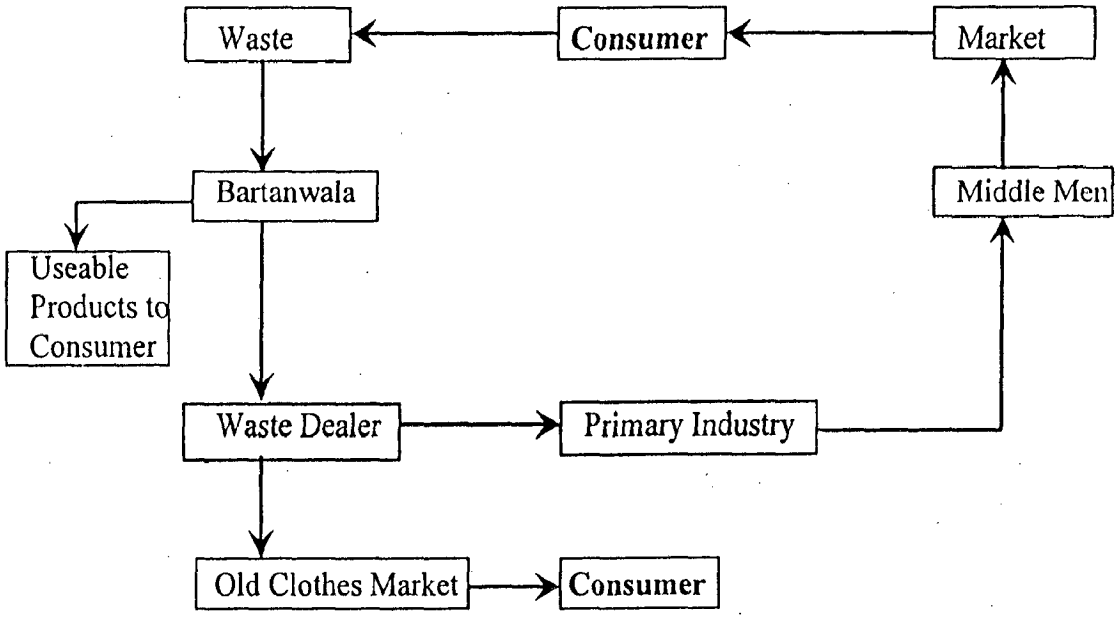


FIG 4.4 **Plastic Products**



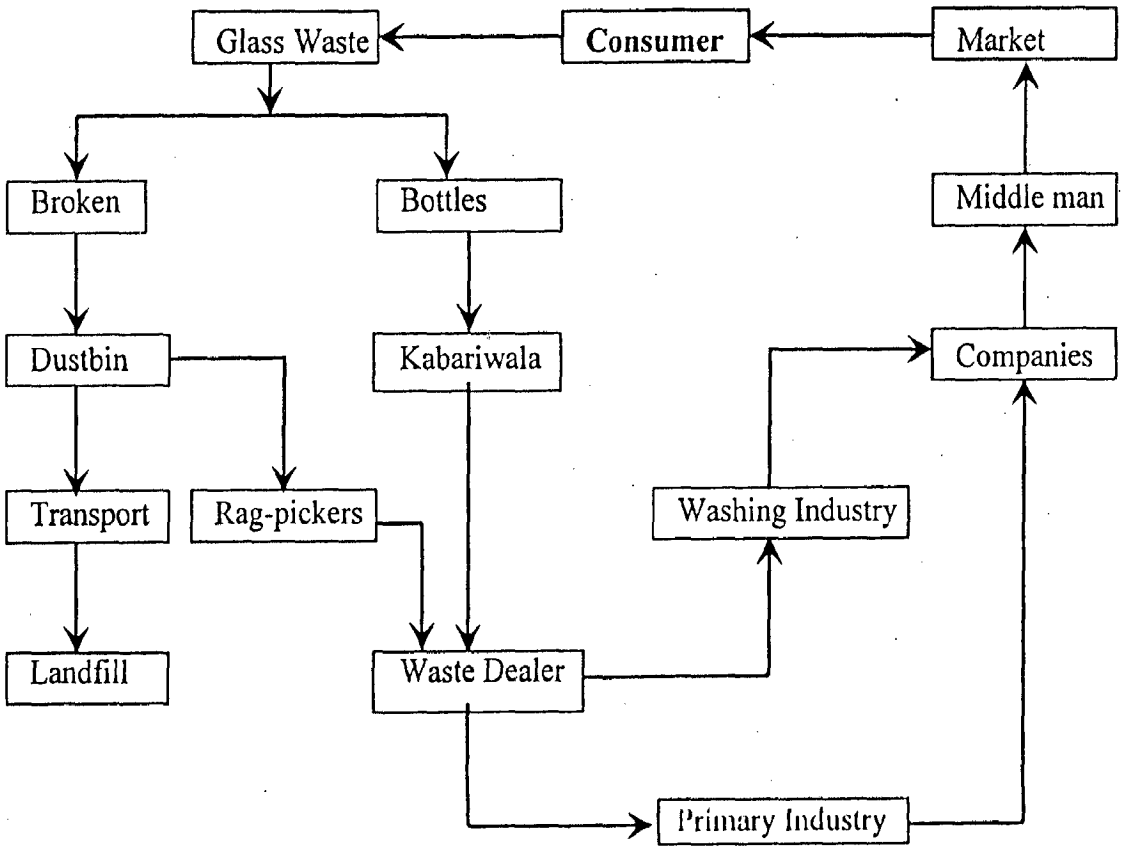
Note: Around 60% of plastic waste generated is recycled and used in manufacturing of various plastic products.

FIG 4.5 OLD CLOTHES



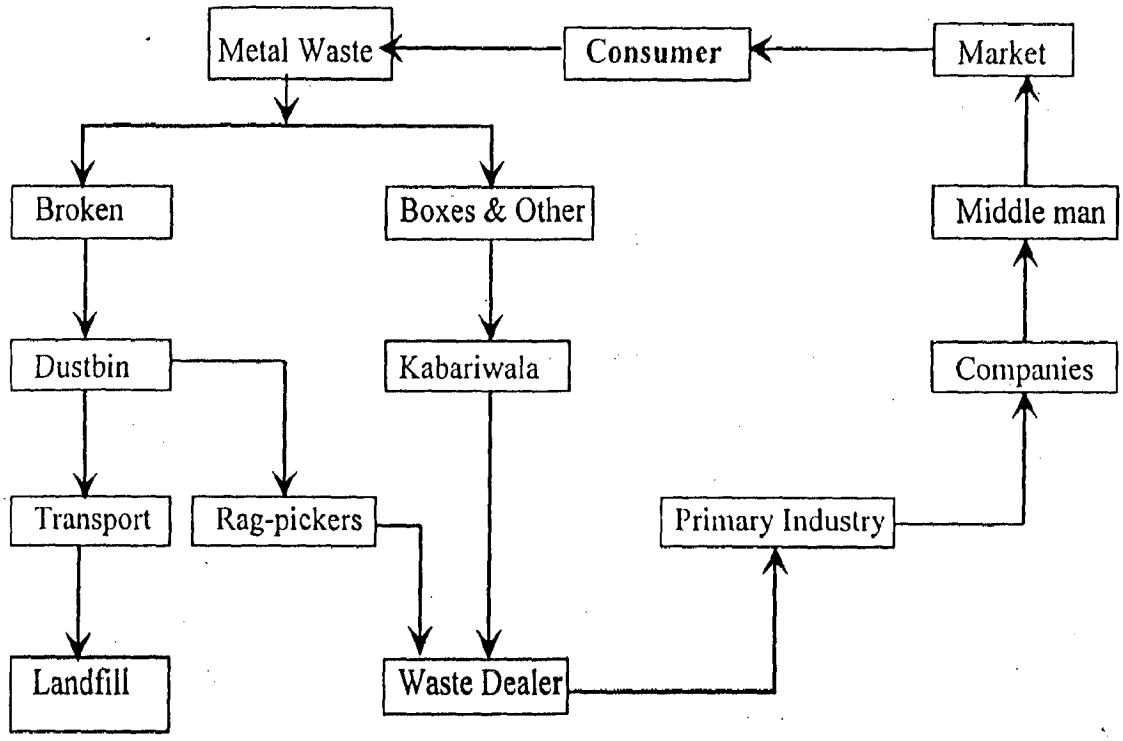
Note: Old Clothes are generally used for making Carpets and poor quality fiber.

FIG 4.6 GLASS WASTE



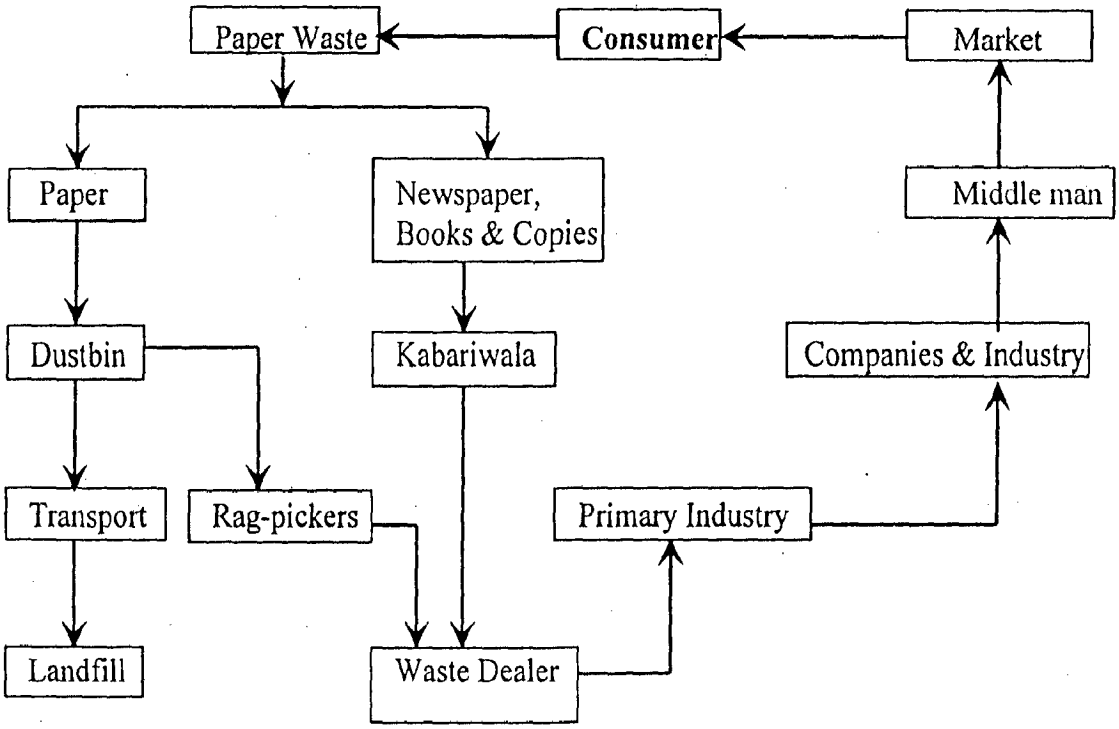
Note: Broken Glass is mould again to make glass products. Bottles are washed and sent back to respected companies.

FIG 4.7 METALLIC WASTE



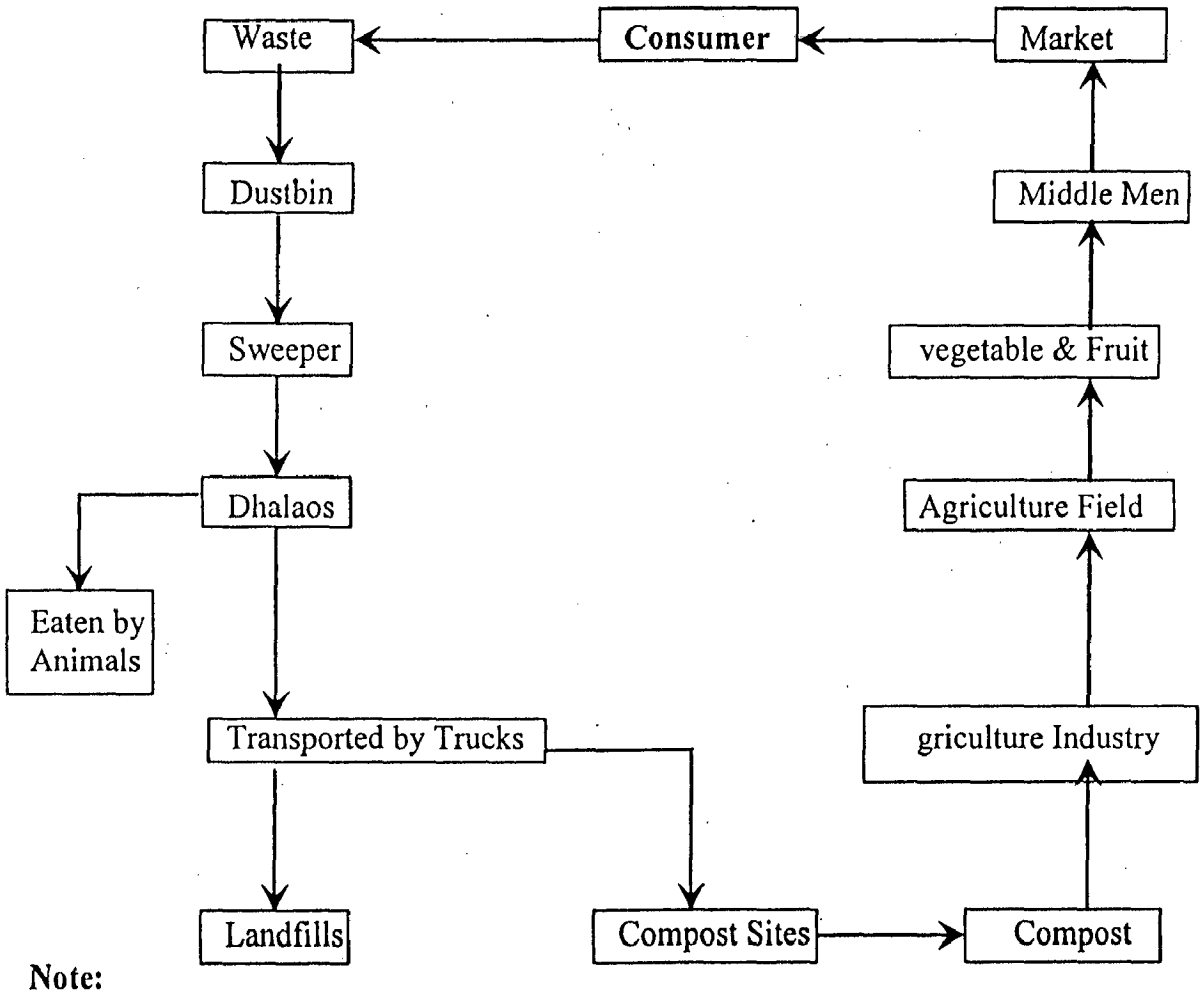
Note: Metal waste is mould and used for making Metallic Products.

FIG 4.8 PAPER WASTE



Note: Paper waste is used for making poor quality paper and various types of Boards.

FIG 4.9 VEGETABLES & OTHER ORGANIC WASTE



Note:

Organic waste constitute nearly 45% of total waste and it was found only 7-10% of overall waste is used for making compost and remaining is decomposed at Landfills. This organic waste attracts birds and other animals at sites which create nuisance.

In the recent past, private sectors have taken initiatives to use this waste as a profitable venture.

4.1.6 Some of the technological options available are listed below:

1. Biomethanation

2. Sanitary Landfill gas

3. Pelletisation

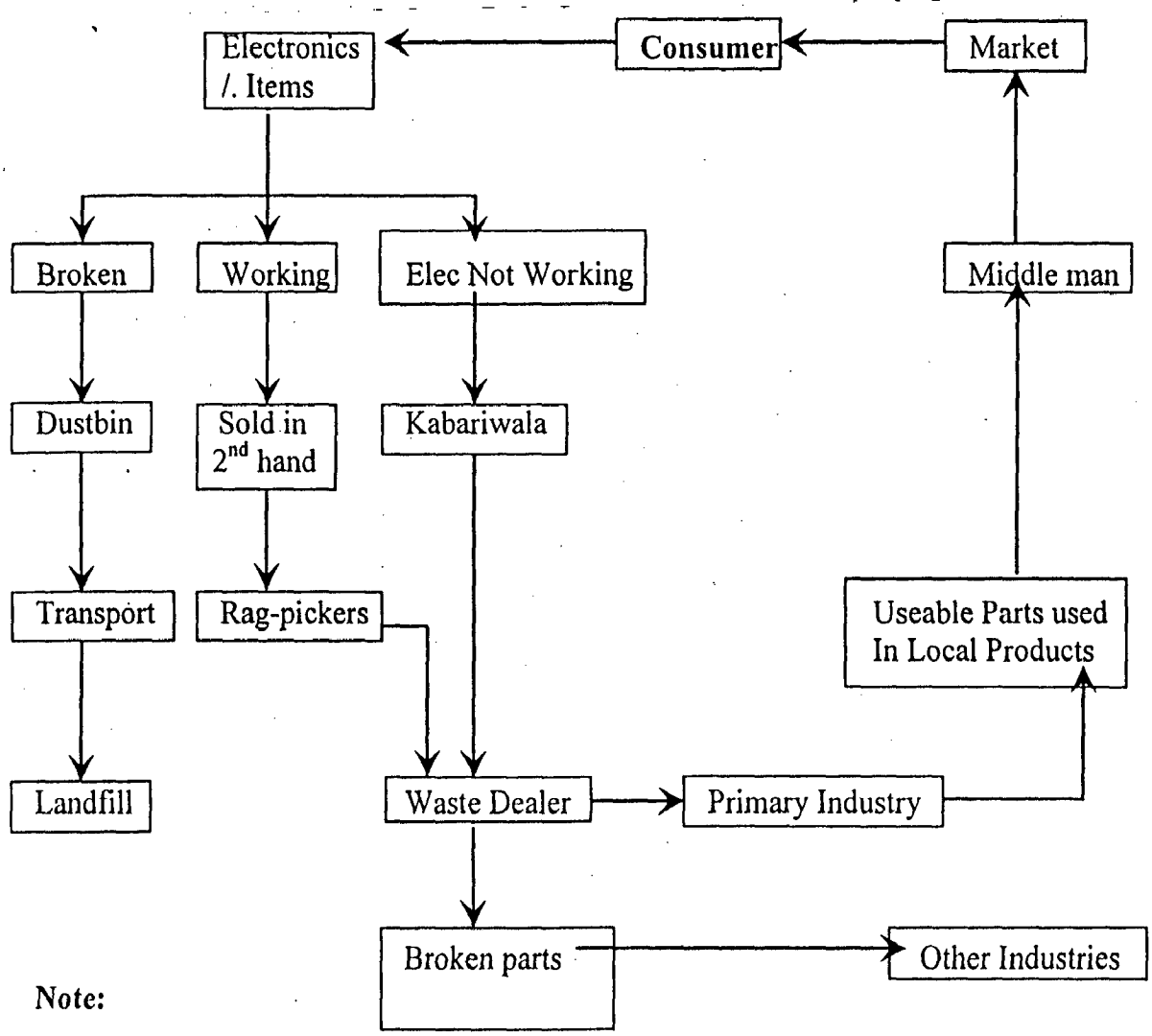
4. Pyrolysis

5. Incineration

6. Composting

However, because of the higher cost of production, these techniques are under trial.

FIG 4.10 ELECTRONICS ITEM WASTE



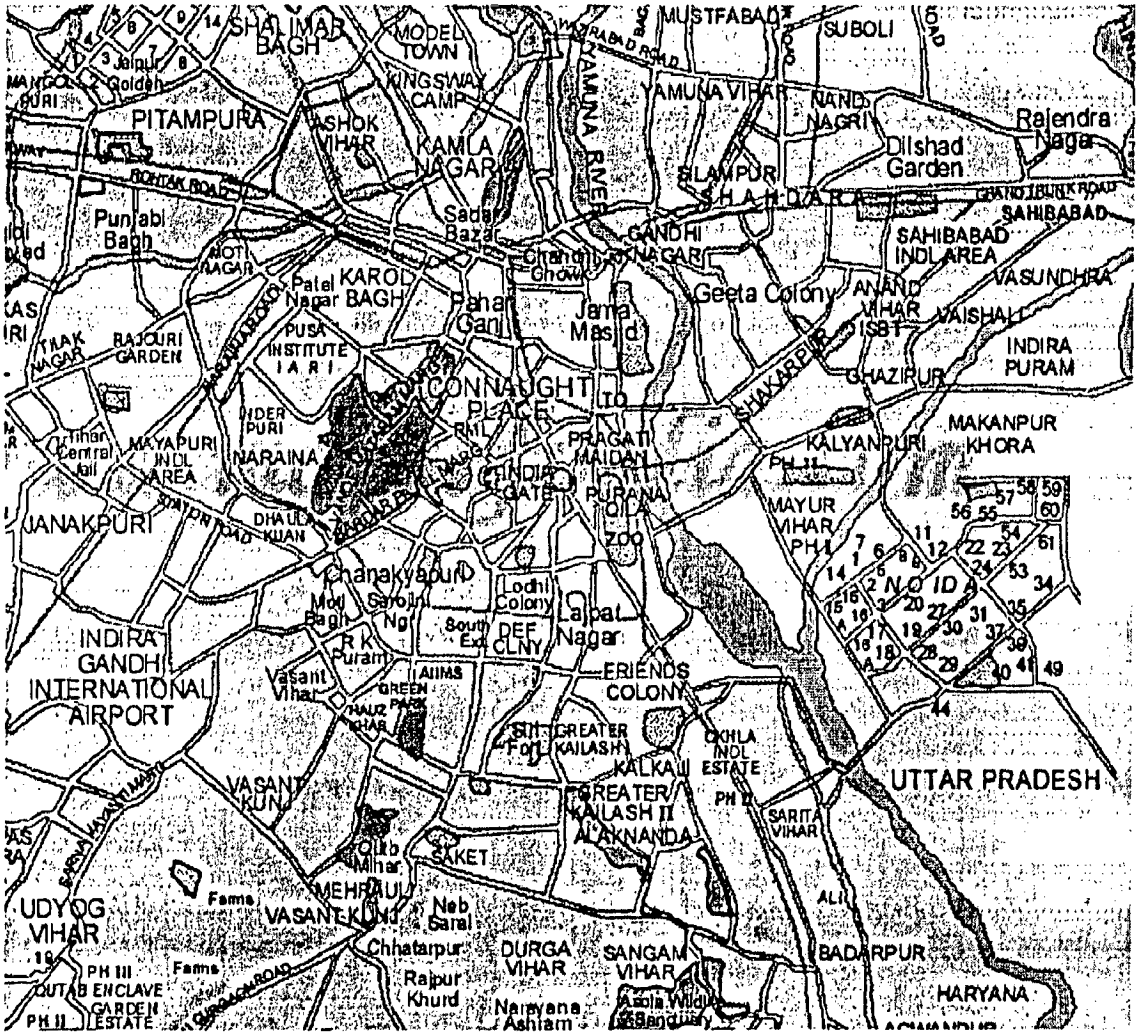
Note:

Generally, the electronics items which are in working condition are sold in Second hand.

The items which are not working are sold to kabariwala, which in turn sold to waste dealer.

The waste dealer segregates the parts and useful items are sold to local manufacturer.

Other part goes in waste in industries based on their material and recycled to use in some other manner.



PLAN 4.1: DELHI

FIG 4.1.1: Building construction material on the side of road

➢

- Treated and Untreated waste both are ultimately mixed in River Yamuna.
- Treatment of waste is basically done to lower the BOD.
- Solid waste/Sludge is used as compost.

In the recent past, private sectors have taken initiatives to use this waste as a profitable venture.
One such company is running in Delhi, which generate 10MLD of purified water from the waste. However, because of higher investment requirement public sectors are not coming with fullest.

GENERAL INFORMATION

4.1.7 Major Waste/Junk Dealers in Delhi

Paper	Pandav Nagar, Dilshad Garden
Glass	Trilok Puri
Iron	Seema Puri, Maya Puri.
Plastic	Jwala Puri
Metal & Alloys	Turkman Gate, Maya Puri
Electronics/Electrical	Seelampur.

4.1.8 Landfill Sites in Delhi

1. **Gazipur**
2. **Balsava**
3. **Hastsal**
4. **Behind Tuglaquabad Fort**

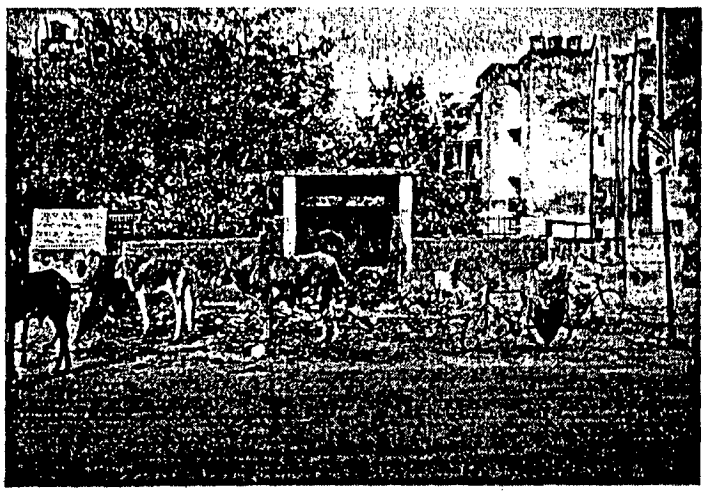


FIG 4.1.2: Garbage littering along the road side

DOMESTIC WASTE COMPOSITION:

Liquid/Sewage waste

Domestic	3,000MLD
Domestic + Industrial	3,600MLD
No. of Drains	22

Treatment Plant	15		
Capacity of Treatment	1,800MLD		
2. Municipal Solid Waste generation		6,000TPD	0.475Kg/day/person.

3. Water requirement 3,650 MLD **Supply** 2,750MLD
Remaining fulfilled through Boring and other sources.

MCD Area	Water supply	250ltr/day/person	as per norms.
NDMC Area	Water supply	400ltr/day/person	

4.1.9 Role of Rag-Pickers in Garbage cycle

Number of Waste Collector, Waste Dealer and Rag-Pickers are around 20,000.

- Rag-pickers play a key role in the management of garbage. They work day and night on the garbage dump site to collect the recyclable materials.
- They segregate the materials at dhalaos/dustbin sites and make a living out of discarded material.
- After segregation of material, they sell it to kabariwala.

Composition of Rag-Pickers

77% of rag-picking is done by female workers and 85% are illiterate.

About 44% of Rag-Pickers earn up to Rs. 8.0/- per day and 13% of rag-pickers earn Rs. 18/- per day or little above.

4.1.10 Garbage System in Delhi (Real Facts):

1. Sewage treatment plants treat only 5-10% of liquid waste.
2. Solid waste lies here and there and most of the landfill sites are full and Delhi left with very little space for landfill sites.
3. Govt. recycling plants are not functioning.
4. Converting waste into useful products cost very high, due to this most of the techniques are not utilized.
5. Present waste receptacles are not working due to their poor maintenance.

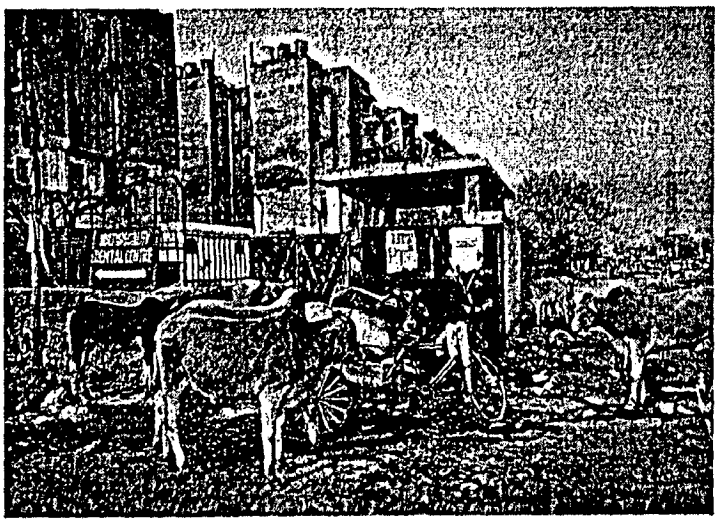


FIG 4.1.3: animals eating waste

6 .The availability of waste collection centers is inadequate and people are disposing garbage in a haphazard manner.

7. Garbage is being disposed in drains, manholes, parks, streets and back-lanes.

8. Garbage is burnt on streets and in colonies.

9. Sludge, after cleaning of drains is dumped on streets and lanes, and not removed.

10. Trucks carrying garbage remain open and are a great public nuisance.

11. Stray animals around dustbins and on streets cause great danger to public.

However, it is found that recyclable waste which is around 15-20% of total solid waste is recycled by private sector companies only.

CASE STUDY 2

4.2 LUCKNOW[2]

4.2.1. INTRODUCTION

LUCKNOW IS the capital of Uttar Pradesh State in North India. While the city grew at a moderate pace from 1951 to 1981, it experienced a high population growth and spatial expansion in the decade 1981- 91. Lucknow is predominately a "services" city, providing employment in administration, trade and commerce, communications, storage and transportation. The main features of the city are:

Population, 1991 **1.7 million**

Projected 2001 **2.9 million**

Population growth, 1981-91 **66 per cent**

Area, 1991 **338 sq km**

Number of households, 1991 **280,000**

Low-income households, 1991 **100,000**

Employment in service sector, 1991 **71 per cent**

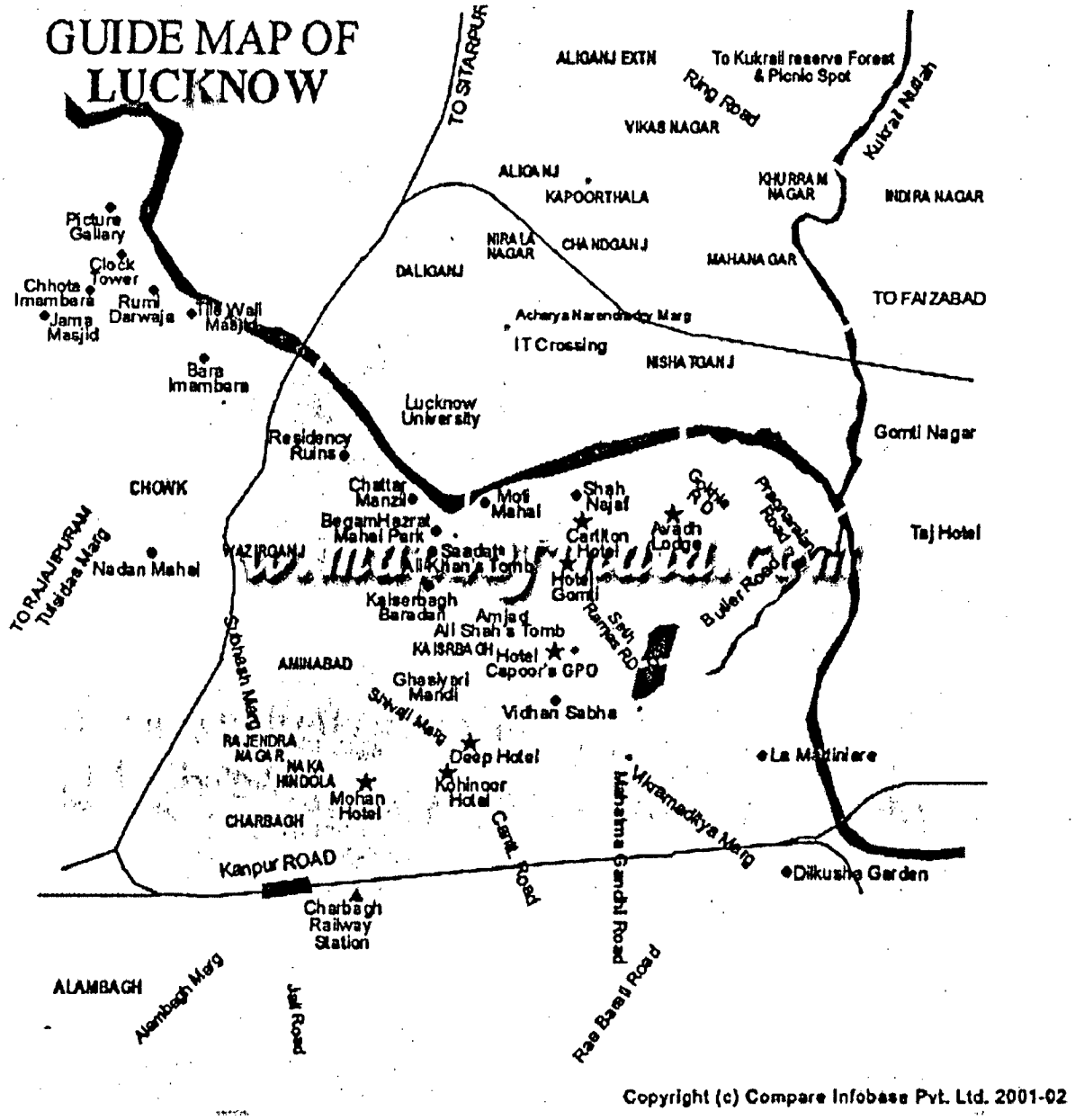
4.2.2. CLEANING SYSTEM

The streets in these localities are swept once a week. By about 11.00 a.m., the cycle trolley operators take the waste to a central point where MJS rag-pickers sift saleable material from the collected waste. The remaining waste is picked up from these central points by tractor trolleys and taken either to the landfill, or to the composting site in Rasoolpur Kayasth outside Lucknow city.

4.2.3. COMPOSITION OF WASTE

Approximately 40 per cent of the waste is inorganic material, such as cardboard, paper, plastic, rubber, leather, textiles, metal, glass and bricks. Half of the inorganic waste, such as metal, glass, plastic and paper, is recovered by the rag-pickers for resale by MJS while the remaining waste, mainly ash and soil, is sent to the landfill site outside the city. Organic waste collected daily consists of waste from plants, fruits and vegetables, hay and cow dung. Vegetable and fruit markets. Cow dung is purchased by MJS from private dairies in the city whenever required. The organic waste collected is used to make compost and liquid fertilizer in the MJS's Vermi-composting unit. its scientists at the

site in Lucknow to supervise the compost production process, and to conduct agricultural Vermin-composting



PLAN 4.2.1: LUCKNOW

Lucknow

- The municipal population of Lucknow is 13.5 lacks.
- Area is 338 sq kilometers population density 3994 persons/ km^2
- There are 11 Kaksh Samiti and 110 wards.
- Daily about 1200 tonnes of SW is collected and only 900 tonnes are disposed off.

- Each Kakach Samiti has 10 wards.
- This Kakch Samiti is responsible for the maintenance of the wards. the hierarchy of the staff is
- Supervisors.
- The population of the wards are almost uniformly distributed which has been kept about 10 to 20 thousands.
- The area of the wards has been tried to keep uniform

The collection system

1. The **primary team** is composed of sanitary workers with wheel barrow cleaning the streets.
2. They dump in the intermediate dumping stations.
3. There is no provision of grading of SW.
4. No recycling process is involved.
5. These dumping stations are not at any fixed intervals or have any proper structure; these are mere the places where people randomly throw the SW, where more SW is collected that becomes the dumping station.
6. Secondary team is composed of vehicles.
7. There are six zones of secondary collection.
8. There are two dumping sites in Lucknow.
9. A. Ash bag

   B .Jankipuram

These sites are overflowing

7. At this time no alternative site is available for dumping the SW in the future.

4.2.4. INFERENCES FROM THE CASE STUDY.

i. There is no proper system of solid waste management in the town.

ii. The efficiency of the municipality is not more than 60 %.

ii. The number of garbage bins are not sufficient, people just thrown the refuse any where besides the road.

iii. There is system of refuse collection from houses.

iv. There is no system of garbage separation.

v. No system of garbage recycling is involved.

vi. The place of the garbage bins is not fixed. They are fixed randomly.

vii. There is provision of treating hospital waste in incinerators but the incinerator does not work.

viii. There was provision of generating electricity from the waste but the plant could not get minimum required waste which could run the plant.

CASE STUDY.3.

4.3.1 COST ANALYSIS OF SOLID WASTE MANAGEMENT IN IIT ROORKEE CAMPUS

CASE STUDY DONE IN IIT ROORKEE CAMPUS

According to the case study of Solid Waste Management done in the campus.

It is found that there is reduction of cost in the Solid waste management if it is done by the contract.

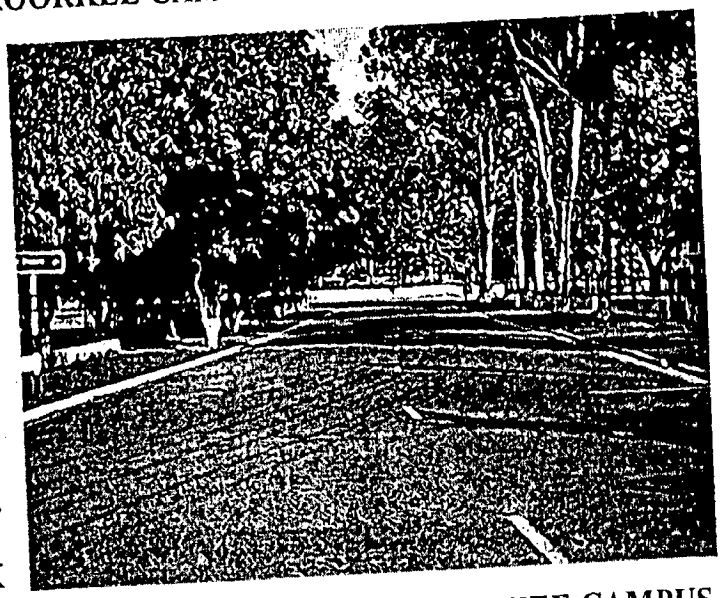


FIG 4.3.1: IIT ROORKEE CAMPUS

4.3.2 REDUCTION IN COST BY GIVING THE WORK ON CONTRACT

Contractors can do the same kind of work at 30 % less amount to the actual cost done by the municipal department. The cost is reduced because contractors can use their workmanship in better and efficient manner.[4]

They keep their worker at daily wedges. Which are 80 rs per day monthly payment not more than rs 2400 per month; where as in municipality the workers has to be given the forth grade pay scale which is 2550-3200 plus 60 % DA which amounts more than 4000 per month.

Contractors can increase or reduce the number of workers according to the requirement. The municipal staff keeps supervision of the daily disposal work.

In case of negligence the contractor has to give penalty to municipality.

Requirement of the sanitary workers in the campus.

Population of the campus is 12000

Depending on the population, no of families 12000/5 = 2400

Standard is to provide on sanitary staff per 70 families.

So required no of sanitary staff = 2400/70=34 only.

Exiting staff set up in IIT Roorkee campus.

Sweepers (East Ward) = 28

Sweepers (West Ward) = 16

Total No. of sweepers = 44

The salary of different sweepers varies from Rs.4000 to Rs.70000 depending upon their working experience. So I have taken the average salary of sweepers is Rs. 5500.

Total salary of different sweepers (per/year) = 44 × 5500 × 12

= Rs. 2,904,000

For transportation of solid waste from community bins to dumping site

Proposed tender rate = Rs. 865,000 /year

Cost of tender accepted = 30% below than proposal cost

= 865,000 – 0.30 × 865,000

= Rs. 519,000 /year

Total cost of solid waste management in I I T campus = 519,000 + 2,904,000

= Rs. 3,423,000 / year

Total generation of solid waste =7985 kg. /d

= (7985 × 365)/100

= 2914.525 ton/year

Cost of solid waste transportation per ton = 3,423,000/2914.525

= Rs.1174.46 /ton

4.3.4 Municipal Solid Waste generation rate in I I T Roorkee Campus and their possible reselling rate[3]

TABLE 4.3.1

S.No	Item	Generation (Kg/d)	Annual Generation (Kg/year)	Cost of reselling Rs./Kg	Revenue generated Rs./year
1	Leaves, Food Waste, Grass	2552.88	931801.20	.....	.....
2	Paper	1103.76	402872.40	4.00	1,611,490
3	Plastics, Rubber	394.2	143883.00	7.00	1,007,181
4	Rags	473.04	172659.60	.....	.....
5	Glass, Ceramics	315.36	115106.4	0.75	86,329.00
6	Metals	23.652	8632.98	9.00	77,696.00
7	Bricks, Stones, Dirt, Ashes	3074.76	1122287.40	150/t	168343.00
8	Wood	47.304	17265.96	0.75	12,949.00

Total revenue generated due to reselling of waste (at source segregation)

= Rs. 2963988.00/ year app

Total reselling type of waste = 1103.76 + 394.20 + 315.36 + 23.652 + 3074.76 + 47.304

= 4,959.036 Kg/d

= 1,810.05 t/year

Cost of transportation of reselling type waste = 1,810.05 × 1174.46

= Rs. 2,125,831.323

If segregated at disposal site then revenue generated

= 2, 963988– 2,125,831.323

= Rs 838157

$$\% \text{ Benefit due to source segregation} = \frac{(2,963988 - 838157)}{2,963988} \times 100$$

= 71% app

4.3.5 Conclusion – By the segregation at the source the solid waste is reduced to 50 %. OR The revenue generated by the selling of recyclable waste reduces the cost of transportation by 70 %.

References:

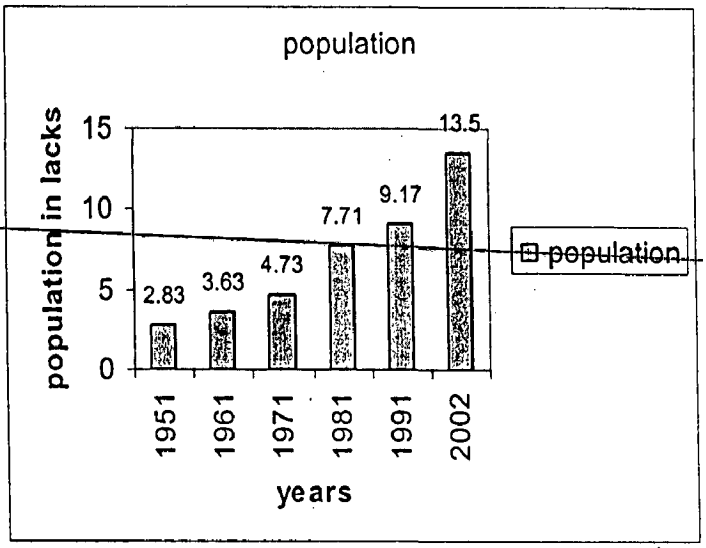
1. Delhi municipal board.
2. Lucknow Municipal Corporation
3. Department of Civil engg. IIT Roorkee.
4. Roorkee Municipal Board.

CHAPTER.5

5.1 ANALYSIS

After the industrial revolution the pace of urbanization has experienced rapid growth in the urbanization. Due to industrialization cities began to grow; new urban centers were formed; existing cities grew larger. This rapid urbanization gave rise to such problems which was never experienced before.

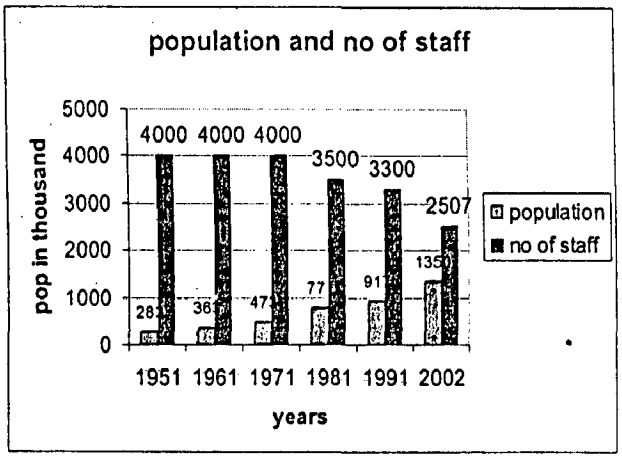
Developing countries especially India is a dense country. Population density in India is far much than the other developed and developing countries. Due to large population load and population density urbanization took place in haphazard manner in India. The rate of urbanization in India is about 50% decadal growth. Provisions of urban infrastructure has however could not keep pace with the increasing size and population of the cities.



GRAPH 5.1: Population growth in Patna[1]

In today's world when market system and economic activities are the governing factor. The economic condition of any city acts as development index. Better the economic condition more is the development. More the development; better the infrastructural facilities in the city.

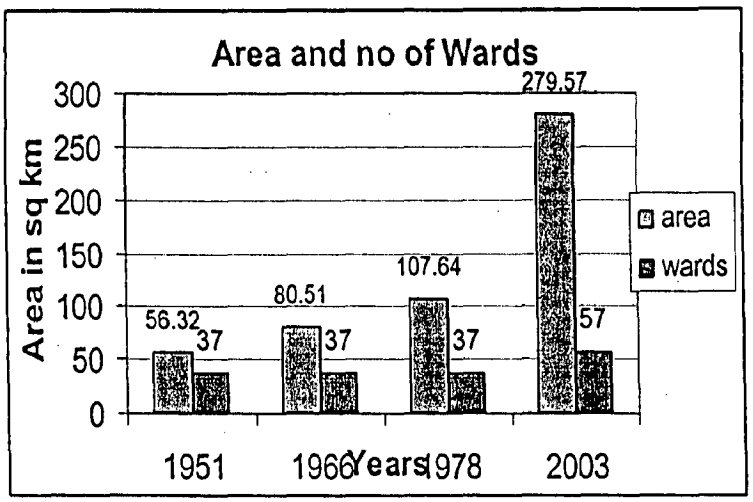
We can make the conclusion that without the development of infrastructure economic development is not possible. Better infrastructural facilities ensure smooth functioning of the city.



GRAPH 5.2: Population and number of staff.[2]

5.2 DESCRIPTION OF PMC STAFF SET UP AND PROBLEMS

Having population of 18 lacks including floating and fixed population the pant municipal area produces about 800 tonnes SW .PMC is lacking in staff ,machineries and automobiles is unable to carry out its work efficiently. The PMC has not sufficient staff set up; one third of the persons available are inefficient. In 1952 when it was established had 3700 sanitary workers when the population was only two lacks .Today when the population and area has increased to seven or eight times the available sanitary workers left are only 2700. Out of them one fourth of them are old not able to work but it is not possible to release from work.



GRAPH 5.3: Area and number of wards [3]

5.3 Existing no automobiles and staff in the Patna Municipal Corporation[4]

No of automobiles and workers	Nutan Rajdhani Anchal	Bankipur Anchal	Patna City Anchal	Total
Tractors (working)	25	17	19	61
Tractors(not working)	22	1	23	46
Tripper (working)	10	2	2	14
Tripper(not working)	4	6	1	11
Payloader(working)	2	1	1	4
Payloader (not working)	3	4	5	12
Pump(working)	8	-	-	8
Pump(Not working)	18	-	-	18
Sanitary Workers	797	615	657	2069

5.4 Calculation of the required number of sanitary workers and auto-mobiles

It is supposed that the waste produced per head is 0.5 kg daily. (National average)

So the total waste produced is (including floating population) 18,00,000x0.5= 900 tonnes per day.

The capacity of tractor to carry the SW is 1.5 tonnes.

Capacity of the tripper is 4.5 tonnes.

Per household the number of the persons is five.

One sanitary worker is required for 70 families (UN standard 3 sanitary workers per 1000 population).

One tractor makes four trips a day.

5.5 TABLE: No of automobiles and sanitary workers required[6]

No of automobiles and workers required	Nutan Rajdhani Anchal	Bankipur Anchal	Patna City Anchal	Total
Tractors	73	54	41	168
Tripper				
Pay loader				
Pump				
Sanitary Workers	1689	1252	955	3896

The additional number of sanitary workers required is 3869-2069= 1827.

The required sanitary workers can be hired on the contract basis also.

5.6 ROLE OF INFRASRUCTURE:

Infrastructure may be defined as the frame work of facilities, utilities and support system through which goods and services are provided to the public. These facilities are of two types:

1. Social and 2.Physical

Physical infrastructure comprises of:

Road network

Electricity

Water supply

Sewerage & drainage

Solid waste disposal system

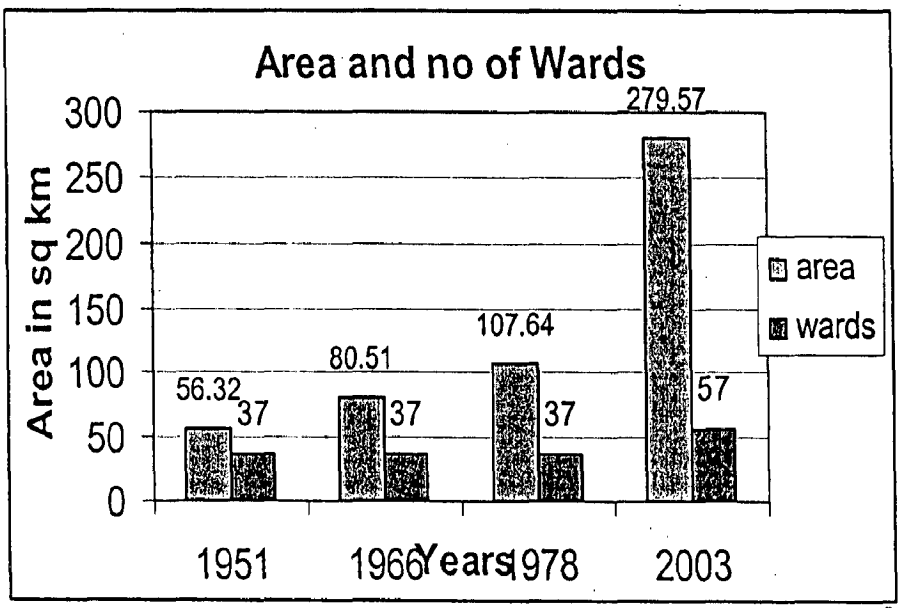
5.8 RELEVANCE OF THE STUDY IN THE CONTEXT OF PATNA:

Patna is one of the oldest cities of the world. It more than 3000 years old .Once it was capital of Indian umpire in the reign of Ashoka the great. Once this city was in excellent conditions according to inscriptions of famous Chinese pilgrim Thuien sang.

Now this city is in miserable condition .Due to fast pace of urbanization the city grew but in haphazard condition. The infrastructure system did not develop according to the contemporary requirement.

5.9 STAFF SET UP OF PATNA MUNICIPAL CORPORATION (PMC)

At this time PMC is in lack of municipal staff and automobiles. The automobiles which are available are not maintained properly .The work shop situated in Patna city is not working properly .In lack of maintenance the available automobiles are not utilized properly. Most of the automobiles remain unused lying in the garages.



GRAPH 5.4: Area and number of wards[7]

5.9.1Nutan Rajdhani Anchal at present having**797** sanitary workers and requirement is 1689 workers. Deficiency is of **892** workers. About **900** sanitary workers can be hired on daily basis or can be taken on contract. On contract basis the total work costs about 30 % lesser than the actual cost calculated by the municipality.

5.9.2 Bankipur Anchal at present having**615** 602 sanitary workers and requirement is **1252**workers. Deficiency is of **637** workers. About **650** sanitary workers can be hired on daily basis or can be taken on contract. On contract basis the total work costs about 30 % lesser than the actual cost calculated by the municipality

Table 5.6: showing the number of sanitary workers, automobiles at present and the required no of sanitary staff and automobiles

	Nutan Rajdhani Anchal	Bankipur Anchal	Patna city Anchal	Total	Required Nutan Anchal	Required Bankipur Anchal	Required Patna city Anchal	Required total
Tractor working	24	20	18	62	73	54	41	95 abt 100
Out of order	22	1	23	46				
Tripper Working	11	2	3	16	20	15	5	40
Out of order	4	6	1	11				
Pay loader(W)	2	1	1	4	10	5	5	20
Not working	4	4	5	13				
Pump(w)	8	-	-	8	10	10	5	
Not working	18	-	-	18				
Sanitary workers	821	602	609	2063	1689	1252	950 or 1000	3892 abt 4000
Population	5,91,279	4,38,341	3,34,552	13,64,172				

5.9.3 Panta City Anchal-at present having 609sanitary workers and requirement is **1000** workers. Deficiency is of **400** workers. About **400** sanitary workers can be hired on daily basis or can be taken on contract. On contract basis the total work (including machines) costs about 30 % lesser than the actual cost calculated by the municipality.

5.10 Area required for the disposal of solid waste produced in Patna Municipal Corporation

Break up of the solid waste in Patna.

Total waste generated

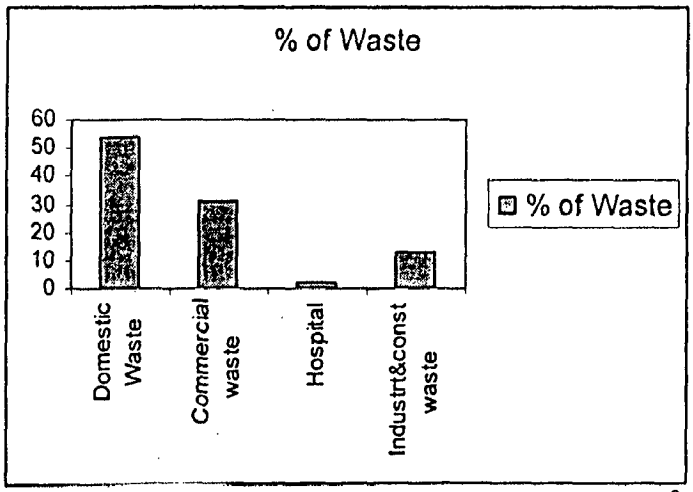
1442932x0.5=721.466 tonnes

1442932x.360=519.45 tonnes

Population including floating population

18 lacks. According to national standard 0.5 kg per head refuse is produced

1800000 x 0.5=900 tonnes



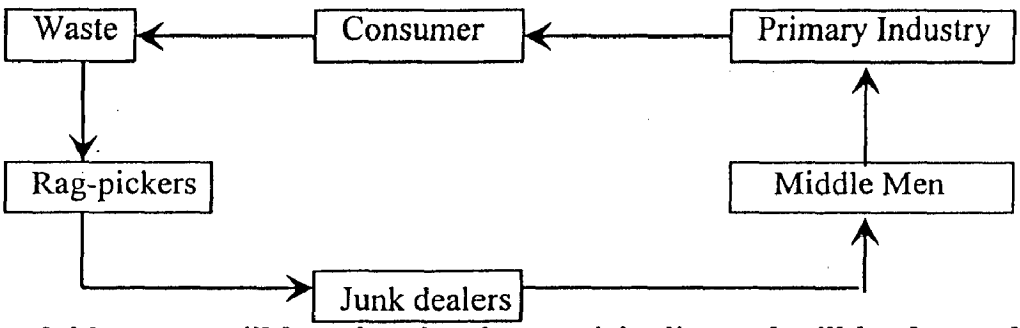
GRAPH 5.5: Break up of solid waste in Patna.[8]

Break up:

54%domestic	486 tonnes
31%commercial	279 tonnes
2% hospital	18 tonnes
13 % industrial &constructional debris	117 tonnes

5.10.1Domestic waste-The waste produced contains mostly the bio degradable waste and non –biodegradable waste or recyclable waste containing papers, card board, broken pieces of glass, ceramics etc will be taken by the rag pickers .They will be recycled in the gray market.

FIG 5.1 Cycle of Recyclable waste



The bio degradable waste will be taken by the municipality and will be dumped in the disposal points.

FIG 5.2 Cycle of Decomposable waste

5.10.2 Hospital Waste- This waste will be treated in the incinerator. The residue obtained is very dangerous in nature like radio active matters. The residue has to be treated with special precaution.

5.10.3 Industrial waste & constructional debris- Industrial waste is mostly of recyclable nature.

5.10.4 Constructional debris –The constructional debris is also of recyclable nature. It is utilized 100 % in the building construction. The debris used as filler in the place of sand.

Thus after reducing all the type of recyclable waste 500 tonnes of bio degradable waste will be left.

5.11. METHODS OF COMPOSTING

If the depth of the pits is kept 2m deep then the area of the pit will be required 125 m^2.

Pit of 12m x 12m will be required

In this method the SW takes 90 days to get decomposed. So 90 pits are made for each day at the end of 90 th day one pit will be vacated at new batch of SW will be dump

Such type of 90 pits will required. The size of the pit will be 12+8 (gap between pits) =20 m

The area required will be 20x20x90= 36000 m^3

36000/4047= 8.9 acres say 9 or 10 acres.

The area proposed is 45 acres so the area is enough.

1. **5.11.1 Composting by windrow method** (Source : Managing solid wastes in developing countries, Edited by *john r. Holmes*,S.N.;1984)

In windrow method the refuse is dumped in pits not more than 2 metres deep. Width of the pit is generally kept 3 metres, length 30 metres. So the volume of the pit will be 30x3x1=90 m^3.

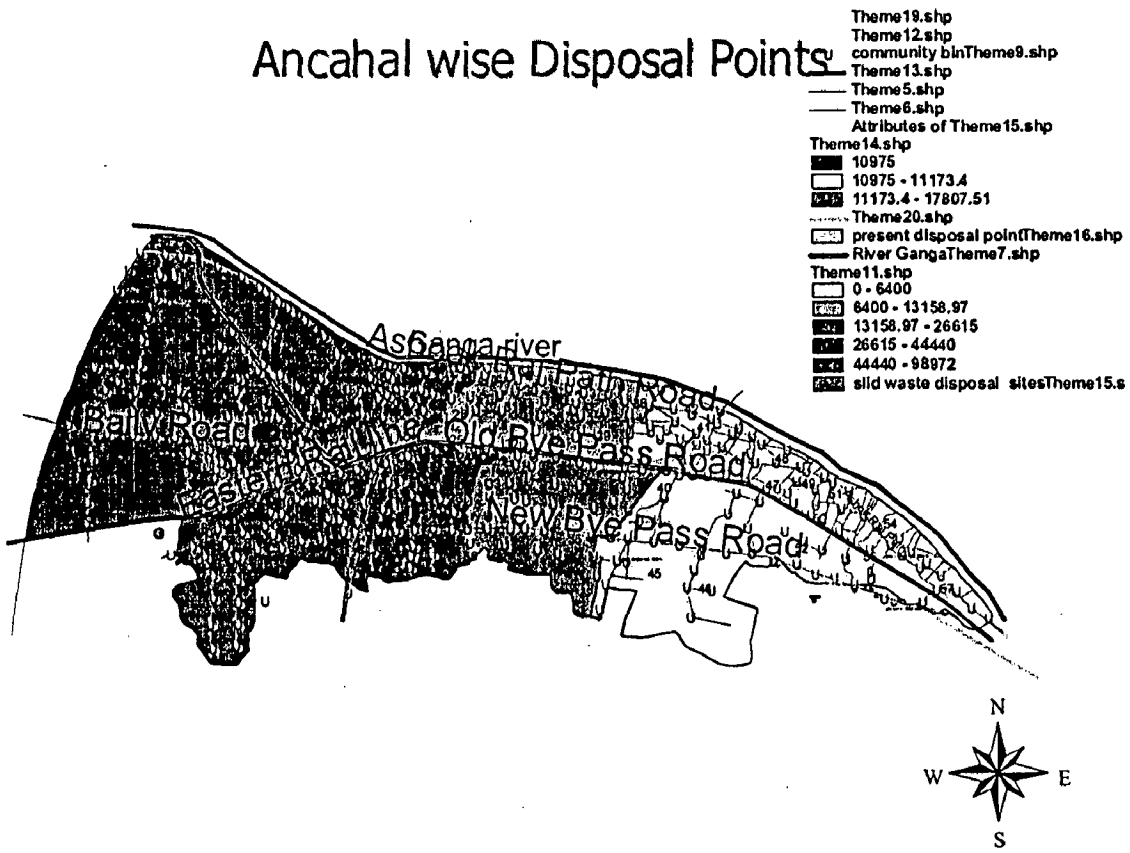
Daily production of waste in Patna is 900 tonnes, after recycling and segregation at the source 500 tonnes of waste is left. The total volume of waste will be 500x0.5=250 m^3 per day. In windrow method it takes 90 days to decompose the waste completely. So number of pits required ~~will be for the total volume of waste produced in 90 days.~~

Total waste produced in 90 days = 90x 250=22500 m^3.

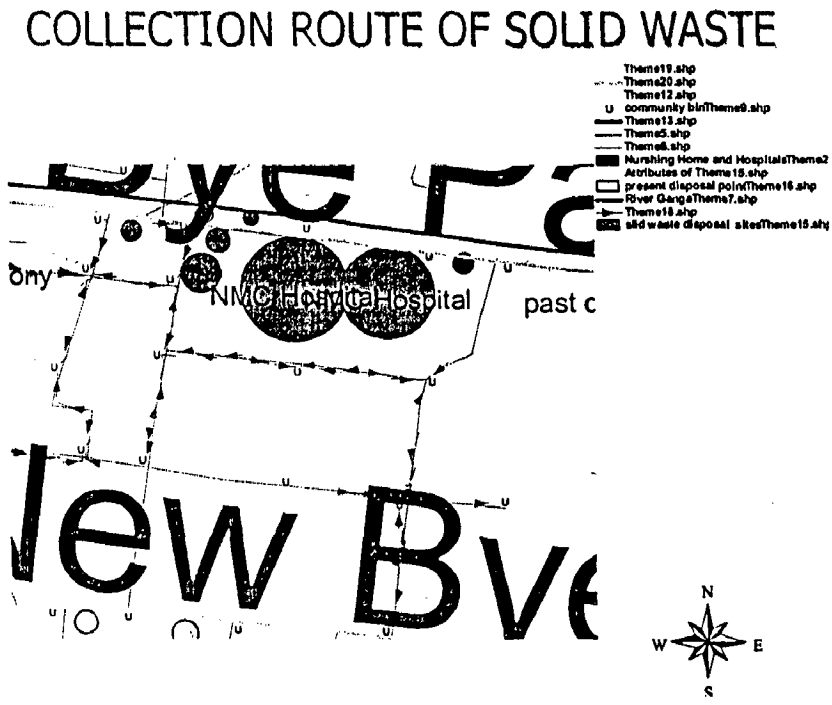
Number of pits required is 22500/90= 250 pits.

References:

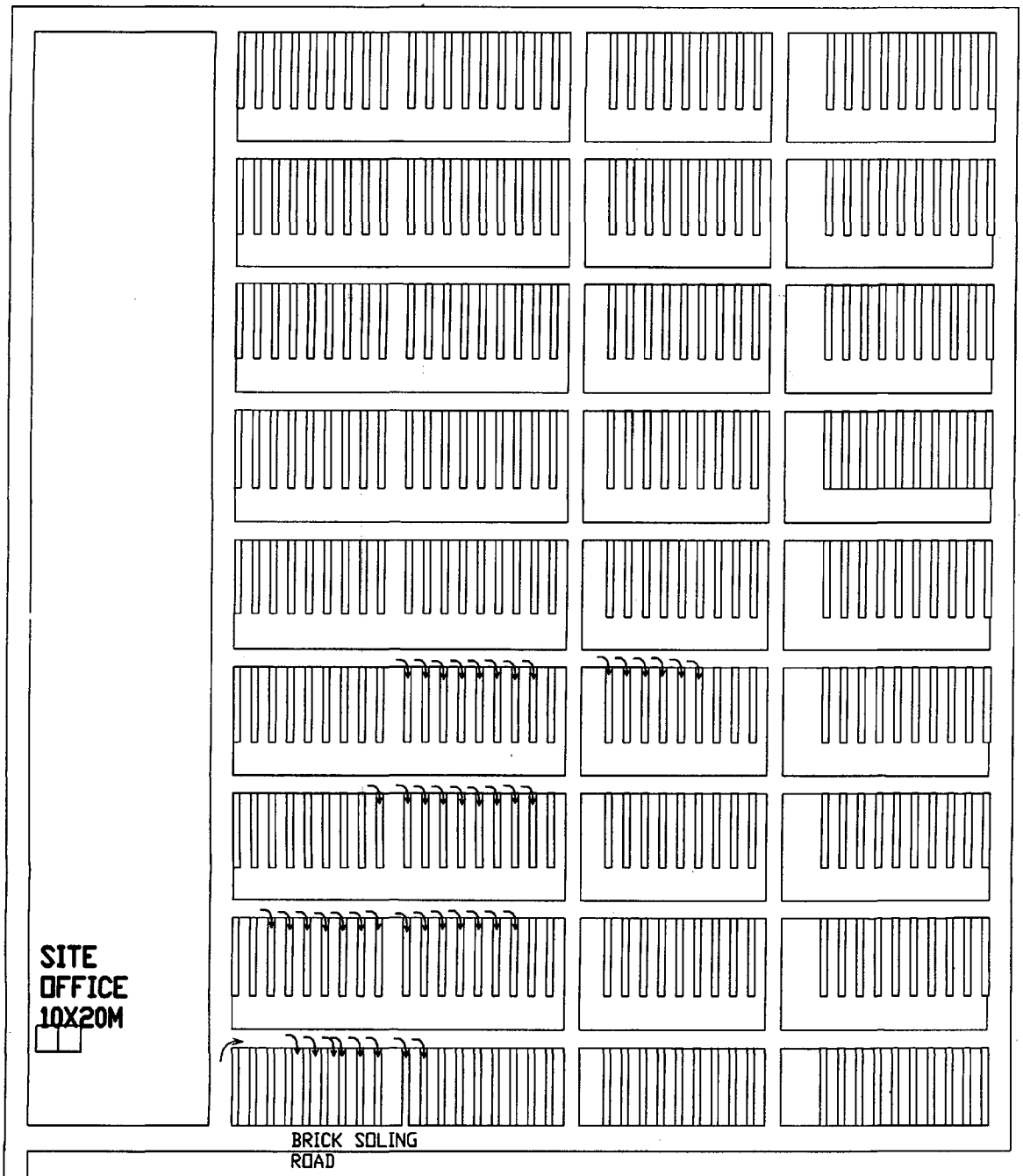
1. Patna Municipal Corporation
2. ibid
3. ibid
4. ibid
5. ibid
6. ibid
7. ibid
8. NIUA



PLAN 5.1: Future arrangement of local bins and community bins disposal points.



PLAN 5.2: Showing the collection route from local bins to community bins.



37x9=333

NO OF PITS

TOTAL
VOLUME
333X180=
59940CUBM
REFUSE PRODUCED
DAILY
500
TONNES,VOL=250CUM
TOTAL VOLUME
REQUIRED
250X90=22500 CUM,250 PITS.

30 M

COMPOST PIT

3 M

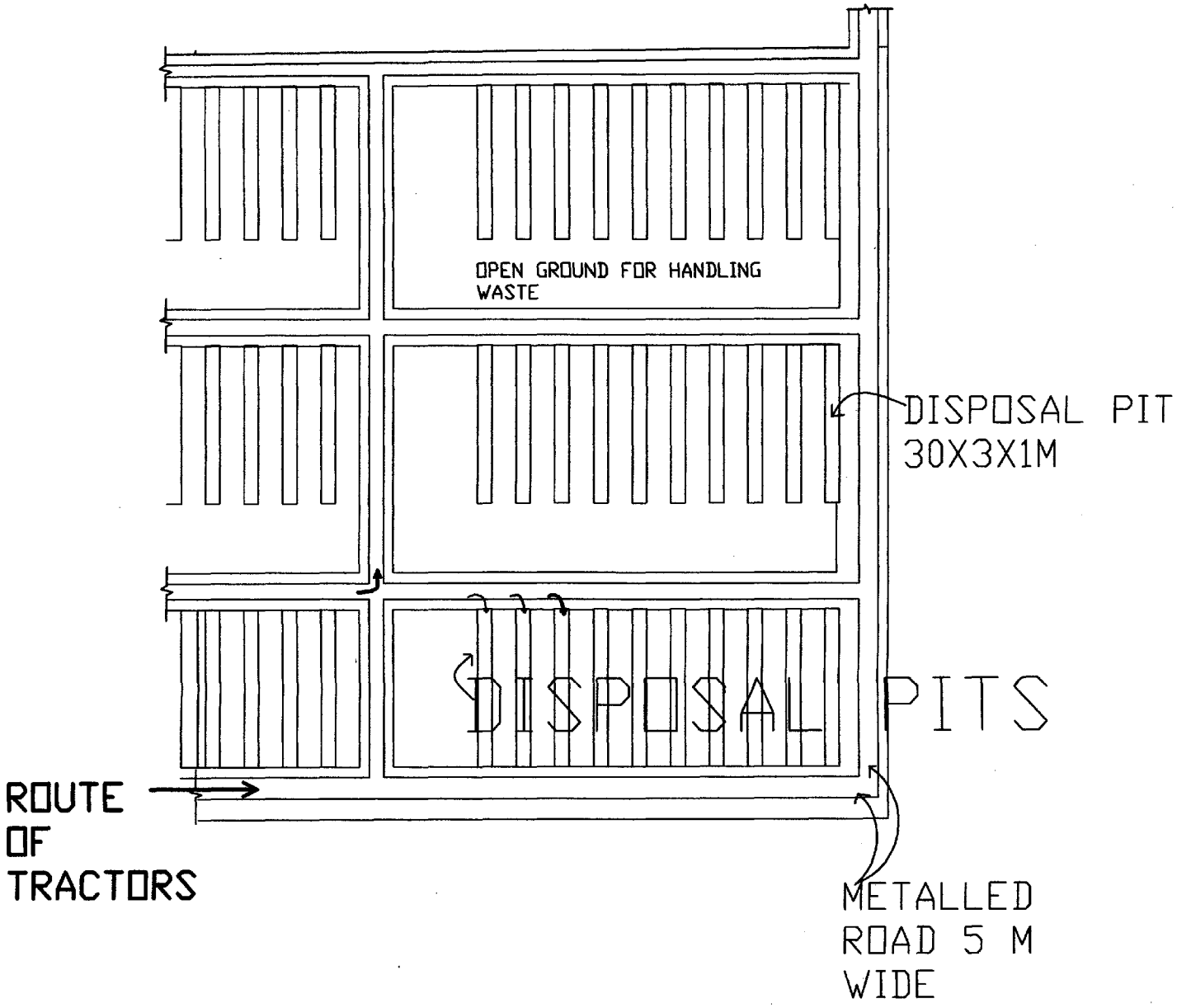
VOL OF PIT
30X3X1=90CUM

DRG NOT TO
SCALE

ROAD

COMPOST SITE AT DISTANC OF 0.5 KM FROM
RESIDENTIAL AREA

DRG 5.1.1 LAYOUT OF COMPOSTING SITE



DRG NOT TO SCALE

DRG 5.1.2 :LAYOUT PLAN- DETAILS OF COMPOSTING SITE

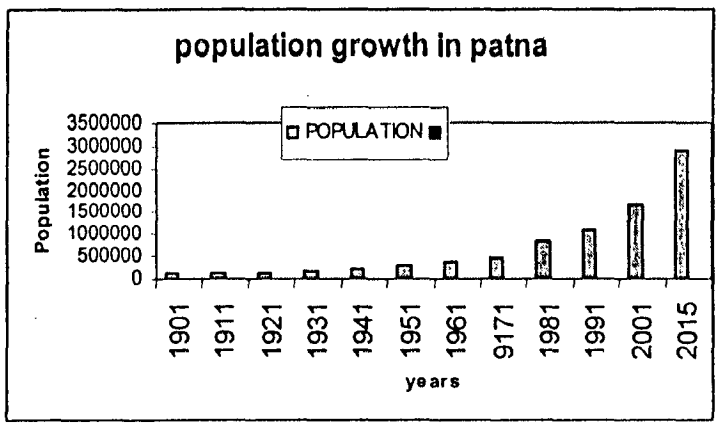
CHAPTER.6

PROJECTIONS.

6.1Population growth

The population of Patna town in 1991 as per census report is 10,99,647.It seems that that the population of the city registered maximum growth during 1971-81 and second higher growth rate was seen in 1951 census which indicates the economic development of the state. After that the rate of population growth dropped to 28.61 %...there after the population of the city trends vary between 28.61 to 29.7 %.

Following that growth trend the projected population for 2001 was 141, 8059 by geometric progression method. Since the population increases with GP and the population of the Patna town population trend of past shows the GP growth .For 2015 the projected population by government agencies for Patna is 28,89,000.[1]



GRAPH 6.1: Population growth Patna

6.2 PROJECTED REQUIRMENTS

IN 2015 the population of Patna will become 28,89,000+ (unknown floating population) about double of the present population. The overall density will increase to more than 8539 persons per km sq. from 11392 persons per km sq.

The area will increase from 118.9 km^2 to 321 km^2.

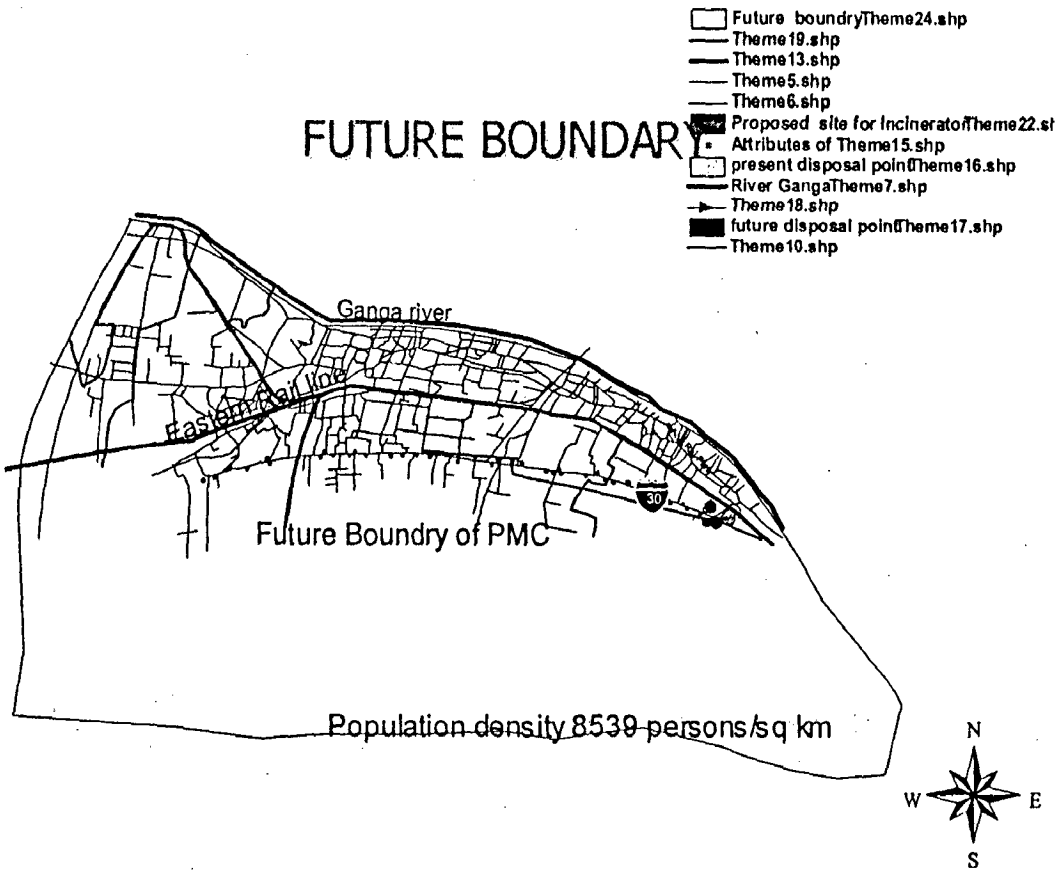
According to the standards of one ward per 15 thousand population .The number of the wards have to be increased from existing 57 to 185.

The productions of the SW will just double the existing 900 tonnes to 1800 tonnes.

The existing infrastructural facilities have to be making just double.

The land required for the disposal of the SW will be double i.e.90 acres (present 45 acres).

Plan 6.1: Future boundary of Patna.



CHAPTER.7

7. PROPOSALS & GUIDE LINES

To make the disposal system effective following are the recommendations:

The management of SWM in a city cannot be considered on isolation. It must be seen in the context of socio-economic as well as infrastructural problems posed by the rapid urbanization and population increases that the city experiences.

7.1 SOLID WASTE GENERATION RATES IN PATNA.

Plan for onsite handling storage and processing of solid waste in Patna.

The prime objective of the solid waste management process has to taken at source of the solid waste i.e. at the generation points of the Municipal Waste. It is essential to have a consistent system and integrated practice for each and every type of MSW namely:

A. Residential

B. Commercial

C. Intuitional

D. Constructional and demolition waste.

E. Hazardous waste.

F. Bulky waste

7.1.1 RESIDENTIAL WASTE.

A. At this time there is no practice of house to house collection system .This will be introduced for the recyclable waste.

A.By the introduction of garbage **segregation at the source**. i.e. bio degradable and non bio degradable waste can be separated at the source. The non bio degradable waste like metal scraps, pieces of glass, plastics, paper and card board products, old wooden materials can be recycled. By this process the SW can be reduced to 50 %.

B.i. Two bins storage system will be practiced.

ii .There will be two types of bins. One for the recyclable waste or bio degradable waste or bio degradable waste. The bins will be of at least 10 liters capacity. The container should with handle. The recyclable waste will be carried by the rag pickers identified by the PMC.

This will provide employment opportunities to rag pickers.

C. The garden trimming and wastes consisting of tree braches, dead leaves, and dust will be home composted and disposed at the site. This waste should not be dumped out of the house premises.

D. Items containing harmful waste like dry cells, dead acid batteries, medicines, insecticides, mosquito repellent, phenol compounds, paints varnishes ,waste oils, lubricants will be stored separately and handed over to the collector after informing him.

7.1.2 COMMERCIAL AND INSTUTIONAL WASTE.

HOTELS- Commercial wastes produced by hotels which are generally of degradable type will be stored in bin of 100 liters capacity. This will be disposed off in local garbage bins by the establishment.

EDUCATIONAL INSTUTIONS-These produce mostly recyclable type of waste like papers, this type of waste will be handed over to the rag pickers. The capacity of the bin will be 100 liters.

COMMERCIAL –Other type of waste will be kept in two types of bins of 100 liters capacity.

HOSPITALS AND NURSHING HOMES-These have to keep three types of bins

i .General type of waste-general type of waste will be collected in it. But the recyclable type of waste like empty bottles, medicine bottles should not be handled to the rag pickers other wise they will sell in the gray market to the duplicate makers. They should be broken in the hospital premises and then disposed off.

ii .Bio- medical waste- Non hazardous waste should be treated in PMC incinerator.

iii. Hazardous waste –Labour room waste, infectious disease operation waste, operation theater waste, these should be handled with care and disposed off in hospital premises.

7.2 POPOSAL FOR THE IMPROVEMENT OF SOLID WASTE MANAGEMENT SYSTEM OF PMC.

Increase the number of staff and no of vehicles to meet the requirements.

1. The required sanitary workers can be hired on contract basis also.
2. The main roads sweeping can be given to the private contractors.
3. Bio degradable waste can be directly decomposed and can be used as fertilizer. Buildings having large campus can decompose the bio-degradable SW in their campus.
4. The reduction at the source can be done by putting two types of plastic buckets in the house one for bio degradable waste and other for non bio-degradable waste. The

non degradable waste can be directly collected by rag pickers from the house the rag pickers can recycle that latter. In return of this the PMC can charge some nominal amount from the rag pickers. By this method the SW can be reduced at the source by 30 to 50 % and the problem of disposal can be solved to some extent.

5. Garbage bins has to be provided at regular intervals of two types:
    a. local garbage bins at the interval of 100 meters of 1 tonnes capacity - Here people from the houses will come and throw the garbage.
    b. Community garbage bins at the interval of 500 metes of 4.5 tonnes capacity – The sanitary workers will collect the SW from the local garbage points and dump them in the community bins. From here tractors and trippers will pick up the SW to the disposal sites. These has to placed be placed on the wide and main roads to provide enough space for the movement of vehicles.
6. Incineration plants have to establish to process the hazardous waste. Segregation at the source practice should be introduced and the recycle of the waste should be increased to reduce the production of the waste.
7. The aesthetics and the hygienic condition of the city should be made the matter of common interest of the people by highlighting this topic in the media.
8. Civic senses in the citizens should be developed so that they don't throw the SW besides the road, in the vacant land, parks and play grounds.
9. The public representatives should be compelled to take interest in keeping the open spaces clean. From their fund they can provide garbage bins where PMC cannot provide the bins.
10. In planned colonies housing societies can be held responsible for the maintenance of the open spaces of their area.
11. The industrial establishments, big shops, commercial, institutes, private institutes, shops, market complexes can be given the responsibility by the PMC to keep their surrounding area clean.
12. In return the maintaining establishment can put their sign in that pen space as advertisement. PMC can give them the reward of tax incentives in the return.
13. For the maintenance of the spaces these establishments can hire rag pickers for part time .Picking from theses are will increase their income and their business.

14. The owners of the private land should be fined if they allow any undesirable activity in their plots.

15. Dumping of building materials on the road side should be banned.

16. Use of open spaces for the storage of type of material should be banned.

17. Garage owners leave their old vehicles, old tires besides the road they should be fined if doing so.

18. Garage owners put old tiers out side their shops. They should be encouraged to recycle the tiers by cold resoling or by any method.

19. In lack of their campus old unclaimed vehicles or seized vehicle are left on the road side by police stations. They should be fined by PMC.

20. Nursing homes, hospitals, pathogenic labs etc.throw their bio-medical waste in the open spaces around them.

21. Shopkeepers, hoteliers, butchers, garage owners, vegetable sellers, hawkers should be warned specially and given direction to keep their own garbage bins for the solid waste they produce.

22. Informal activities should be allowed do their activities but they should be not allowed to litter their waste any where.

23. Butchers in the close proximity of aerodrome should be banned for selling meat in open and throwing of their waste in the open.

24. Along the bye Patna bye pass road (NH-30) at particular place dead animals are thrown .The passers by have to bear heavy odor passing by this place. Dogs gather here to eat the dead animals; the dogs hinder traffic. This should be dumped far away from the populated area or the road.

25. Decentralized neighborhood, or business-scale composing - Such facilities can provide a waste management opportunity to a small group of people at a relatively low cost. Small-scale composting uses the wastes of a number of households, shops, or institutions; the composting is done on unused land, beside community gardens, or in parks.

26. In the residential colonies cattle owners keep their cattle in the open spaces which litter cow dung any where.

27. Animal feeding of the kitchen waste- Vegetable or food waste can be given to the animal owners directly feed the animals.

28. Slums should not be allowed to develop in the open spaces.

7.3 GUIDE LINES

GENERAL

From all the studies, case studies and experiences in the solid waste management inferences can be drawn now. For the improvement of the SW management in Patna The following recommendations can be given:

i. The Patna municipal corporation (PMC) should ban throwing of SW on the road side; especially in the commercial areas. Legal provisions should be made for that. Whoever found guilty should be fined.

ii. PMC should provide sufficient number of bins along the road.

iii. Segregation of the waste at site method should be adopted. Two bin collection systems should adopted in the residential, commercial, nursing homes etc.

iv. The Patna municipal corporation (PMC) should charge for the management of SW from the commercial establishments like nursing homes, shops and industries.

v. The accumulation of construction debris and construction material should be banned along the road side.

vi. There should be co-ordination among the various departments so no department should leave its belonging along the road side unattended. For example: Police department, telephone department, PWD, leave their old vehicles unattended along the road side to rot.

vii. PMC should increase the number of wards according to standards.

It is also essential to reinforce the traditional practices of reuse and recycling in the society to keep the waste generation at the minimum. The various government and non government agencies should promote such programmes at the community level to create awareness, also to minimize waste production.

viii. The factories should be compelled to use zero waste technology in their factories to reduce the production of refuse from the factories.

ix. Factories should be encouraged to recycle the waste as raw materials to reduce the production cost and waste.

7.4. APPLICATION / IMPLEMENTATION STAGE

7.4.1First stage when there is no improvement in revenue generation.

PMC should acquire about 50 acres land at suitable place for the disposal of solid waste

Segregation of the waste at source practice should be practiced in house to house collection.

This will reduce the gross production of SW and will promote the recycle of waste. The selling of the waste will increase the revenue generation for the PMC.

7.4.2 SECOND STAGE

PMC should increase the number of staff to meet the required number of sanitary and other workers.

No of sanitary workers required 4000-2063= about 2000, salary per month to be paid=2000x80(daily wedge) x30=48 lacks

The number of vehicles should be increased to meet the required needs.

No of required tractors 100-62=40x4 (Lacks)

Required trippers 40-16=24x10(Lacks)

Pay loader 20-10=10x10(Lacks)

Local garbage bins has to be provided at the regular intervals of about 50 to 100 meters interval.

Local garbage points- 1406 (of 1.5 tonnes capacity)

PMC should establish -150 (of 4.5 tonnes capacity) Community bins.

PMC should construct incineration plant for the disposal of hazardous and hospital waste.

7.4.3THIRD STAGE

i. The number of wards should be increased based on the population standards (on ward for 15 thousand people) according to the increased number of wards, the staff set up should be increased accordingly.

ii. Introduction of Zero waste technology in the factories.

iii ,In the future there should be effort to reduce the production of waste by recycling of waste and introduction of zero waste technology.

iv. The practice of land fill has to be reduced as the cost of the land will go on increasing in the future.

CHAPTER.8

CONCLUSION

Solid waste management is essential to keep the city clean and healthy .The solid waste management in this city is not functioning properly. It is the matter of serious concern for this city. Every year in the rainy season infectious diseases spread due to the inefficient SWM, people become ill.

Patna Municipal Corporation (PMC) was established in 1952. After its establishment its efficiency went on decreasing because it cold not improves its conditions. In lack of proper function it could generate not enough revenue meet its requirements.

Today Patna it is considered as on of the dirty cities of the country. The bad image of the city hinders the development of this city. The population of this city went on increasing but the number of staff went on decreasing

PMC has total 57 wards having population of 14 lacks. Its area is 118 km^2. There is no separate department for the management of solid wastes in PMC .In each division this wok is done under the supervision of sanitary inspector.

Patna is growing at the rate of 50% decadal growth or even more (there is no record of unauthorized construction and population). The population of this city went on increasing but the number of staff went on decreasing.

The study area of this project is the municipal area of Patna.

This proposed project gives proposal for the improvement of the existing SWM system in Patna. Proposal will improve the SWM system including collection, transportation, segregation and disposal of the waste.

The proposed project will improve the environmental conditions of the city. City will have a healthy look and the image of the city will improve hence it will be one of the clean cities of the country.

This figure 8.1 shows the relation ship among the solid waste management of the city and the development of the city. When the solid waste management of the city will be better then the hygienic condition of the city will increase. City will become clean and beautiful.

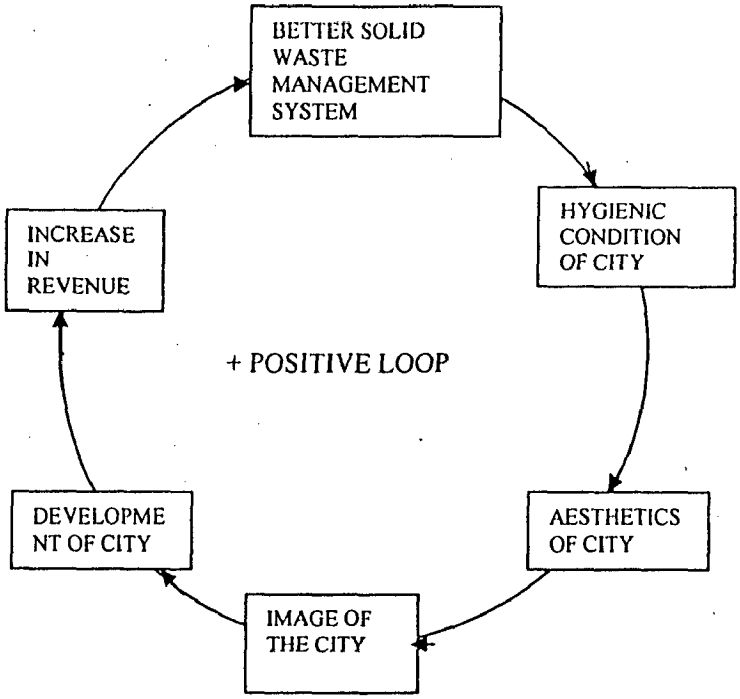


FIGURE 8.1

There will be betterment in the image of the city. The better image of the city will attract the business men and investors and entrepreneurs. Business industrial, activities will increase in the city. This will result in the over all growth of the city, the revenue generation in the city will increase. The income of the PMC will increase .PMC will be able to spend money in the infrastructural facilities in the city.

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APPENDIX.....

I.NEWS OF SOLID WASTE MANAGEMENT

II.GLOSSERY OF TERMS

Pay for your own trash

By Anuradha Mukherjee/TNN

Uday

New Delhi: May be it's time you went easy on the coke can and other packaged food. No this is not a health advice— the MCD is considering levying an urban environment improvement tax.

Basically, it means that you pay for the garbage you generate. And the more upscale the colony you live in, the higher the tax may be.

"We are considering charging a cess for the disposal and treatment of garbage. This money can be used for developing infrastructure to recycle and treat waste. But levying the same level of tax may not be fair because the kind of garbage a household generates is directly linked to its income," said MCD commissioner Rakesh Mehta.

"We will offer subsidy for part of the cost of garbage generated in colonies categorised under a lower tax slab, but the well-off can pay for themselves," he added.

At present, the city produces over 6,000 metric tonne (MT) waste every day. This is estimated to go up to 12,000 MT by year 2024. According to Mehta, adopting a "pollutor pays" policy may actually help cut Delhi's daily garbage output, besides help set up infrastructure to treat and dispose garbage as per international standards.

"Space for setting up new landfill sites is limited. While recycling non-biodegradable waste and composting bio-degradable waste is one solution, we also need to discourage waste generation. If you have to pay money, you are more careful," he said.

This may also include taxing products like refrigerators that generate more waste that is difficult to dispose.

"That's the practice all over the world — in Europe and United States of America. They charge value added tax (VAT) and disposal tax. The revenue raised goes to the municipal body," Mehta explained.

DELHI

MCD to develop new landfills by 2008

TIMES NEWS NETWORK

New Delhi: The MCD now has its task cut out as far as the disposal and treatment of garbage is concerned. According to the master plan for solid waste treatment and disposal, the civic agency will have to develop three new landfills, close the existing ones and start two new composts facilities in the city — all within four years — 2008.

"They will also have to set up two facilities for processing construction waste (*malba*). The work on developing new landfill sites will have to begin in the next one year," said project manager and teamleader Jan Skajaa of COWI, the Danish consultant, that has helped prepare the report.

TREATING WASTE

- The MCD is running three landfill sites — Bhalswa, Gazipur and Okhla
- These sites are expected to last for the next 1 to 4 years
- The city generates 6,000 MT of garbage every day, expected to double by 2024

It envisages a plan for disposal and treatment of solid waste in Delhi for the next 20 years. The plan will be updated and revised every 4 years.

The estimated cost for implementing the project is Rs 3,719 crore, most of which the MCD is expected to generate. For the first five years of the project, a total estimated investment of Rs 935 crore is required.

…फ अध्यक्ष अहसन मिजा… शायरों के … अर्पित किया।

कदमताल कर रहा है कूड़े से बिजली बनाने का संयंत्र

लखनऊ,18 फरवरी (सं.सू.)। जगह-जगह कूड़े का अम्बार है मगर नगर निगम को सड़ने वाला कूड़ा नहीं मिल पा रहा है। नगर निगम की सुस्त चाल से ही कूड़े से बिजली बनाने की परियोजना तेजी नहीं पकड़ पा रही है। वादे के मुताबिक पिछले वर्ष जुलाई माह से ही निर्धारित पांच मेगावाट बिजली बननी चाहिए थी लेकिन अभी परियोजना दो मेगावाट तक ही बिजली का उत्पादन कर पा रही है। पहले कूड़ा न मिलने का रोना निर्माण इकाई ने रोया था लेकिन जब कूड़ा मिलने लगा तो संयंत्र में तकनीकी खराबी का बहाना बनाया गया। अब कूड़ा मिलने में फिर दिक्कत आ रही है। जो कूड़ा संयंत्र स्थल पर पहुंचाया जा रहा है,उसमें सिल्ट की मात्रा अधिक होने से वह अनुपयोगी है।

केन्द्रीय अपारम्पिक ऊर्जा स्रोत मंत्रालय के सहयोग से इस संयंत्र को हरदोई रोड स्थित बरावन खुर्द गांव में लगाया गया था। प्रधानमंत्री अटलबिहारी वाजपेयी ने 26 नवम्बर 1998 को इस परियोजना शिलान्यास किया था। 78 करोड़ रुपये की इस परियोजना को चेन्नई की एशिया बायोएनर्जी संस्था ने लगाया था। नगर निगम की पांच एकड़ जमीन पर लगे इस संयंत्र में नगर निगम को प्रतिदिन तीन सौ टन सड़ने वाला कूड़ा उपलब्ध कराना था पर ऐसा न हो सका। परियोजना से नगर निगम को भी सलाना 65 लाख रुपये की आय होती। नागरिकों से सहयोग के लिए हर घर के बाहर नीले और हरे की दो रंग की बाल्टियां रखने की योजना बनायी गयी थी।

इसके लिए छपवाये गये पोस्टर एवं पर्चे सड़क पर ही नहीं दिख पाये। कूड़ों को अलग-अलग रखने के लिए खरीदी गयी रिक्शा ट्राली ने कुछ कदम चलने के बाद कबाड़ का रुप ले लिया। लेटलतीफी के कारण ही 24 दिसम्बर को प्रधानमंत्री के हाथों परियोजना का उद्घाटन कार्यक्रम स्थगित करना पड़ा था। कूड़ा एकत्र करने की वर्तमान स्थिति भी संतोषजनक नहीं है। शहर के 51 होटल से ही कूड़ा मिल पा रहा है।

इसी तरह इन होटलों से कूड़ा उठाने के लिए लगायीं गयीं चार विक्रम गाड़ियां एक बार में आने-जाने में 60 किलोमीटर रास्ता तय करती हैं। इस कारण कई होटलों में निर्धारित समय में कूड़ा न उठ पाने के कारण मालिकों ने भी कूड़ा देने में अनिच्छा जतायी है। इसके चलते आधुनिक कूड़ाघरों में पृथक कूड़ा एकत्र करने की योजना हवा में नजर आ रही है। नगर आयुक्त श्रीप्रकाश सिंह का कहना है कि 31 मार्च तक उत्पादन पांच मेगावाट हो जायेगा।

27 महीने बाद खुली नींद निगम की

● 31 दिसम्बर तक पर्यावरण कानून लागू करने की मियाद ● परिवर्तन की शुरुआत

पटना (का.सं.)। पर्यावरण मानकों के अनुसार शहर को साफ-सुथरा रखने के सुप्रीम कोर्ट के आदेशों के प्रति 27 महीनों तक खर्राटा भर रहे नगर निगम की गहरी निद्रा अब टूटी है। 31 दिसम्बर तक पर्यावरण कानून लागू करने की मियाद पूरी होने में नौ महीने शेष हैं। निगम ने इस अवधि में कानून लागू करने की रेस में अव्वल आने के लिए फर्राटा दौड़ की तैयारी शुरू कर दी है क्योंकि शहरों में गंदगी दंडनीय अपराध होगा और इसके लिए सजा भी मुकर्रर है। ज्ञात हो, सुप्रीम कोर्ट द्वारा इस वर्ष 31 दिसम्बर तक सभी नगरों में अनिवार्य रूप से पर्यावरण नियंत्रण कानून लागू किये जाने का आदेश वर्ष 2000 में ही दिया गया था। इसके अनुसार शहरों में खुले में कूड़ा फेंकना, बिना ढंके उसे ढोना, जहां-तहां कूड़ा डम्प कर देना, मृत जानवरों को ठिकाने लगाने में देर करना दंडनीय अपराध घोषित किया गया है। कूड़ा प्रबंधन के प्रति नगर निकायों की लापरवाही से शहर गंदगी के पर्याय बन गये हैं। अब जबकि मात्र नौ महीने शेष रह गये हैं, नगर निगम ने कूड़ा ढोनेवाले ट्रैक्टरों और ट्रकों को ढंकने के लिए तिरपाल खरीदने के आदेश दिये हैं। निगम के मुख्य कार्यपालक पदाधिकारी ए.बी. प्रसाद ने बताया कि हालांकि यह तात्कालिक व्यवस्था है। इसलिए फिलहाल तिरपाल खरीदने के लिए निगम के तीनों अंचलों से प्रस्ताव शीघ्र भेजने को कहा गया है। शर्त यह है कि कोई प्रस्ताव 5000 रुपये से अधिक का नहीं हो क्योंकि तब सभी प्रस्तावों को निगम की स्थायी समिति से पैस कराना होगा। निगम में वर्तमान गतिरोध को देखते हुए अधिकारियों ने किसी परेशानी से बचने का यह रास्ता निकाला है। श्री प्रसाद ने बताया कि निगम की कोशिश होगी कि दिसम्बर तक कूड़ा ढोनेवाले सभी वाहनों की बॉडी ढंक दी जाये और हर 500 मीटर की दूरी पर ढक्कनयुक्त कूड़ादान रखे जायें। इसके अलावा खुले में मांस-मुर्गा और मछली काटना तथा बेचना भी पर्यावरण कानूनों तथा पशु क्रूरता निवारण अधिनियम के तहत दंडनीय अपराध भी है। इस पर भी रोक लगायी जायेगी। कानून के अनुसार अगले वर्ष एक जनवरी से किसी शहर या मुहल्ले के गंदा रहने पर न सिर्फ नगर निकायों के अफसरान ही नहीं बल्कि वार्डों के जनप्रतिनिधि भी जेल जायेंगे। वह भी पांच सालों के लिए एक लाख जुर्माने के साथ क्योंकि संबंधित वार्डों के जनप्रतिनिधि, विभाग के अधिकारी न्यायालय के आदेश की अवहेलना के दोषी होंगे। यही नहीं, अगर दोबारा उस इलाके की शिकायत आयी तो सजा की अवधि सात वर्ष होगी। लोगों को सिर्फ इतना करना होगा कि उन्हें संबंधित इलाकों में सफाई नहीं होने की शिकायत सबूत सहित केंद्रीय या राज्य प्रदूषण नियंत्रण पर्षद के समक्ष करनी होगी। 10 March

जैविक खाद बनाकर ही मिलेगी कचरे से मुक्ति

● 70 फीसदी कचरे का पुन: उपयोग संभव ● इनसिनरेटर की जरूरत सिर्फ संक्रमित कचरे के लिए

● 'ठोस एवं अस्पताल कचरे का प्रबंधन' विषय पर कार्यशाला

कार्यशाला का उद्घाटन किया नगर विकास सचिव अजय कुमार ने

पटना (हि.प्र.)। राजधानी केकचरे का 70 फीसदी कार्बनिक कचरा होता है और इससे जैविक खाद तैयार कर इसका पुन: उपयोग किया जा सकता है। अस्पतालों से निकलने वाले बायो मेडिकल कचरे में भी मात्र 10 प्रतिशत कचरा ही जलाने लायक होता है। सामुदायिक आधारित जैविक खाद बनाने की व्यवस्था कर कम खर्च में शहर को कचरा मुक्त किया जा सकता है। चकाचक पटना अभियान के अन्तर्गत स्थानीय स्काडा बिजनेस सेन्टर में 'ठोस एवं अस्पताल कचरे का प्रबंधन' विषय पर आयोजित कार्यशाला में वक्ताओं की यह आम राय थी। कार्यशाला को दिल्ली के 'पर्यावरण शिक्षण केन्द्र' के विशेषज्ञों ने संबोधित किया। कार्यशाला का उद्घाटन करते हुए राज्य के नगर विकास विभाग सचिव अजय कुमार ने कहा कि सरकार पटना के पार्कों में सामुदायिक आधारित जैविक खाद निर्माण के लिए जमीन उपलब्ध कराने को तैयार है। 'पर्यावरण शिक्षण केन्द्र' के परियोजना अधिकारी अनिल कुमार ने बताया कि सामान्यतया दो हजार घरों वाले मुहल्लों के लिए मात्र दो सौ वर्ग मीटर जमीन में यह व्यवस्था की जा सकती है। उन्होंने बताया किप्रतिदिन पटना में 7 टन बायो मेडिकल कचरा निकलता है जिसमें 7 सौ किलो कचरा को ही जलाने की जरूरत है। इसके लिए शहर को कुल क्षेत्रों में बांटकर हर क्षेत्र में इनसिनरेटर की व्यवस्था की जा सकती है। बाकी सभी कचरे से प्राकृतिक खाद बनाकर जमीन की उर्वरा शक्ति को बढ़ाया जा सकता है। उन्होंने कहा कि पशुओं के अवशिष्ट, रसोई का कचरा, बाग-बगीचा का कचरा और असंक्रमित कचरा से खाद तैयार कर इसका पुन: उपयोग किया जा सकता है। ऐसे कचरे को सड़ाने-गलाने के लिए ऐनोरोबिक, बायोमिथेनेशन, एयरोबिक, हीप प्रक्रिया, पिट और बर्कली प्रक्रिया का प्रयोग किया जा सकता है। वर्मी कम्पोस्टिंग करके भी कचरे में कमी लायी जा सकती है। श्री कुमार ने बताया किअस्पताल के कचरे को 5 भागों में बांटकर उसका सम्पूर्ण प्रबंधन किया जा सकता है। अस्पतालों से साधारण कचरा, पैनी वस्तुएं, संक्रमित कचरा, रसायनिक एवं द्रव्य कचरा तथा संक्रमित प्लास्टिकनिकलते हैं। साधारण कचरा और प्लास्टिक कचरा का पुनर्चक्रण कर उपयोग में लाया जा सकता है। केवल संक्रमित कचरा को ही इनसिनरेटर में जलाने की आवश्यकता है। कार्यशाला को पटना नगर निगम के मुख्य कार्यपालक पदाधिकारी ए.बी. प्रसाद, पटना क्षेत्रीय विकास प्राधिकार के उपाध्यक्ष चैतन्य प्रसाद, यूनिसेफ के दीपक राय, पर्यावरण शिक्षण केन्द्र की राष्ट्रीय समन्वयक श्यामला कृष्णा, कार्यक्रम समन्वयकअर्चना डांगे, स्माल ग्रेन्ट्स प्रोग्राम के राष्ट्रीय समन्वयक प्रभजोत सोढ़ी सहित राजधानी केकई नर्सिंग होम के प्रबंधकऔर चिकित्सक भी उपस्थित थे।

हिन्दुस्तान

समस्याओं के भंवर में डूबते उतराते पटना सिटी के लोग

'धावा' पटनासिटी

आम हैं इस तरह के कूड़े के ढेर, धावा टीम से समस्याएं बताने आए लोग *छाया: हिन्दुस्तान*

पटना (का.सं.)। सड़कों पर अतिक्रमण और फल, सब्जी, मांस, मुर्गे की दुकानें तथा छुट्टा घूमते सांढ़। एक नहीं छह-छह और सांढ़ भी ऐसे वैसे नहीं। संतोष, महेश, गणेश जैसे नाम वाले जो नाम पुकारने पर पास आ जाते हैं। इन सांढ़ों ने एक को तो यमलोक पहुंचा दिया और अनेक को घायल कर बिस्तर पर लिटा दिया है। सबसे ज्यादा परेशानी महिलाओं, बच्चों और बूढ़ों को है। पानी के लिए चापाकलों पर भटकते लोग और नगर निगम की काहिली और कंगाली से जाम नाले। बढ़ती आबादी, सिकुड़ती सड़कें। पुरानी, संकरी गलियों और गंगा घाटों पर गंदगी का ढेर तथा वहां नौजवानों को अंधकारमय भविष्य की ओर ढकेलती स्मैक, शराब की खुलेआम बिक्री। किरासनचालित टेम्पुओं के जहरीले धुएं में प्राचीन पाटलिपुत्र के गौरव को यादकर अकुलाते और इलाके के समेकित विकास की बाट जोहते लोग। पुरानी बोरिंग के बदले नई बोरिंग के तहत पटना जल पर्षद ने पूर्वी पटना में 14 स्थानों का चयन किया लेकिन हुआ यह कि अनेक जगहों पर नई तो चालू हुई नहीं, पुरानी बोरिंग को भी बंद कर दिया गया। थक हारकर वार्ड पार्षद और उप महापौर संतोष मेहता को हाई कोर्ट में गाड़ीखाना स्थित नई बोरिंग को चालू कराने के लिए याचिका दायर करनी पड़ी। सुदर्शन पथ में नाला पर से अगम कुआं तक कहीं स्ट्रीट लाइट नहीं है। इससे दुर्घटनाओं और अपराध में बेतहाशा वृद्धि हो रही है। समस्याएं अंतहीन, समाधान नदारद। कुल मिलाकर यही पहचान है पटना सिटी की। रविवार को 'हिन्दुस्तान' की धावा टीम चौक शिकारपुर इलाके में जन समस्याओं से रू-ब-रू होने विश्वकर्मा सामुदायिक भवन में पहुंची तो न सिर्फ वार्ड संख्या 52 बल्कि 46, 47, 50, 51 और 53 के भी दर्जनों लोग वहां उपस्थित थे। सभी अपनी समस्याएं सुनाने को आतुर। बड़ी मुश्किल से शिकायतों को व्यवस्थित किया जा सका। सबसे ज्यादा गुस्सा नगर निगम और पुलिस की कार्यशैली पर। जलनिकासी के लिए बने नाले जाम, गलियों में कूड़े का ढेर, यदा-कदा सड़कों पर झाड़ू पड़ जाए तो गनीमत, पीने के पानी की कमी और जो पानी मिल रहा है, वह पीने लायक नहीं। नाला पर निवासी अधिवक्ता संतोष कुमार सिंह ने बताया कि एक तरफ लोगों को पीने के लिए पानी नहीं मिलता तो दूसरी तरफ सड़कों के किनारे सार्वजनिक नलों से बहते पानी की बर्बादी की शिकायत पर कोई कार्रवाई नहीं होती है। इस वार्ड में कुल मिलाकर दो नई बोरिंग हैं। इसमें एक मंगल तालाब मुख्य द्वार पर तथा दूसरा गाड़ीखाना में जो आज तक ट्रांसफार्मर के अभाव में चालू नहीं किया जा सका। मंगल तालाब स्थित बोरिंग तीन- चार महीने पहले चालू की गई है लेकिन समस्या यथावत है। वार्ड संख्या 46 निवासी, सामाजिक कार्यकर्ता उदरहमापुर निवासी सुरेश सिंह ने बताया कि यहां जलापूर्ति के लिए तीन बोरिंग हैं। चौथी रानीपुर में तैयार है। इसके बावजूद मेंहदीगंज, उदरहमापुर, रानीपुर तथा बेलदार टोली समेत दर्जनों मुहल्लों में जलसंकट से लोग परेशान हैं। 1995 में पूर्वी विधान सभा के लिए 9 बोरिंग स्वीकृत हुई थी जिसमें से तुलसी मंडी, इमामबाड़ा और चिल्ड्रेन्स पार्क की बोरिंग आज तक चालू नहीं की गई। लोग इसकी मुख्य वजह पटना जल पर्षद और पूर्व के विस्वास बोर्ड के बीच खींचतान बताते हैं। रामपरावन साह, गिरजा प्रसाद, भोला दूबे, देवनाथ प्रसाद ने बताया कि लाल इमली इलाके में भी पानी की समस्या है। इसी तरह खाजेकलां की पुरानी बोरिंग में लगे 100 अश्वशक्ति के मोटर से पर्याप्त पानी मिल रहा था लेकिन इसकी जगह नई बोरिंग में 60 अश्वशक्ति का मोटर लगा दिया गया जिससे समस्या सुलझने की बजाए उलझ गई।

धावा टीम: *मुकुल मिश्र, श्याम नंदन, अतुल उपाध्याय,अमिताभ ओझा रमेश मिश्र पल्लीन रस्तोगी, इशांतुल और छायाकार अरविन्द*

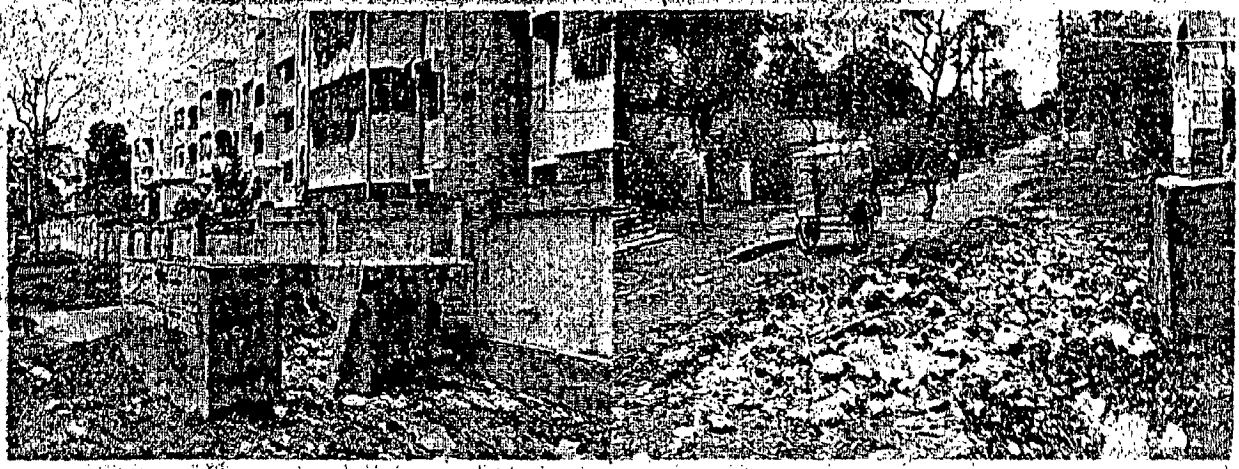
पहचान या दर्द !

- किरासनचालित टेम्पुओं के जहरीले धुएं में प्राचीन पाटलिपुत्र के गौरव को यादकर अकुलाते और इलाके के समेकित विकास की बाट जोहते लोग
- सड़कों पर फल, सब्जी, मांस की अवैध दुकानें
- पानी के लिए भटकतीं महिलाएं
- स्मैक और शराब की बेधड़क बिक्री
- सिद्धपीठ पटनदेवी के रास्ते भी गंदगी से भरे

मोगलपुरा की सही बोरिंग चालू कर नवाब बहादुर रोड की बोरिंग चालू की गई। इसके बावजूद पानी की मात्रा एक बूंद नहीं बढ़ी। चौक मंडल, भाजपा के मंत्री विनय कृष्ण तथा वार्ड संख्या 52 के निवासी बब्लू जायसवाल एवं अरुण कुमार ने बताया कि सड़कों के किनारे तमाम नियम-कानूनों को धता बताकर खुले में मांस, मुर्गे काटे जा रहे हैं। इसका बच्चों पर बुरा असर पड़ता है। सड़कों पर आवारा पशु घूमते हैं जिनसे राहगीरों को हमेशा खतरा बना रहता है। कई घरों की मलनिकासी व्यवस्था को सीधे जलनिकासी के लिए बने नाले से जोड़ दिया गया है। इससे गंदगी फैलती है और संक्रामक बीमारियां फैलने की आशंका बनी रहती है। नाला पर स्थित सब्जी मंडी से सड़क अक्सर जाम रहती है। आवागमन में परेशानी के साथ साथ दुर्घटना की भी आशंका बनी रहती है। श्री कृष्ण ने बताया कि मारवाड़ी स्कूल के सामने और काली स्थान पटनदेवी जानेवाले रास्ते पर कूड़े का ढेर रहता है जिससे श्रद्धालुओं और आम लोगों को काफी परेशानी होती है। वार्ड संख्या 45 के सुरेश प्रसाद की शिकायत है कि शेख बूचड़ चौराहा से नेहरु चक, बड़ी पटनदेवी, ईदगाह रोड होते व्यवहार न्यायालय तक जानेवाली सड़क अत्यंत क्षतिग्रस्त है। उन्होंने इसकी मरम्मत और अतिक्रमण हटाने की मांग की है। कहार टोली निवासी बुलबुल देवी ने बताया कि लोगों द्वारा घरों के आगे ओटा बना कर गली संकरी कर दिए जाने से आवागमन में परेशानी होती है। कोई रिक्शावाला भी अंदर जाना नहीं चाहता है। चौक मंडल भाजपा अध्यक्ष मोती विश्वकर्मा, दुन्दी बाजार निवासी मीना विश्वकर्मा तथा दुन्दी बाजार गली के बगल में रहनेवाली रीता विश्वकर्मा ने बताया कि दुन्दी बाजार अखाड़ा पर सड़क रात में अंधेरे में डूबी रहती है। मंगल तालाब से लेकर चौक शिकारपुर नाला तक सड़क किनारे अवैध रूप से खुलेआम शराब बेची जाती है। महिलाएं इधर से गुजरते वक्त किसी अनहोनी की आशंका से सहमी रहती हैं। वार्ड संख्या 51 के निवासी मोहनलाल यादव ने मारवाड़ी स्कूल की बगल में हम्माम गली के नाले की सफाई नहीं होने पर चिंता जताई। वार्ड संख्या 51 के अन्तर्गत छोटी पटनदेवी गली निवासी शमसेर सिंह अरोड़ा की शिकायत है कि मंदिर के पूरब काफी गंदगी है। इसकी नियमित सफाई हो तो श्रद्धालुओं को मंदिर आने जाने में सहूलियत हो। जुगेश्वर प्रसाद सिन्हा ने बताया कि काली स्थान हरमंदिर गली और कचौड़ी गली की कभी सफाई नहीं होती है।

पढ़ें कल के अंक में

लोग हैं कि मानते नहीं



कूड़ा घर बना है लेकिन लोग इसका इस्तेमाल नहीं करते : सड़क स्वच्छ रखना है लेकिन लोग कूड़ा डालने से बाज नहीं आते

समस्या है कि लोग कचरा कूड़ेदान में फेंकते ही नहीं

आप की बात

संतोष सभापति उर्मिला अंजू बिंदू नलिनी

पटना (हि.प्र.)। गर्दनीबाग स्थित रोड नं 1 के सरकारी आवास में रहने वाले लोगों के लिए बरसात एक भीषण समस्या है। तेज बारिश हुई नहीं कि घरों में पानी घुस जाता है।

लोगों की परेशानी का प्रमुख कारण मोहल्ले की अवैध मांस-मुर्गे की दुकान तथा खटाल हैं, जो अपना कचरा रोड नंबर 1 के नुक्कड़ पर फेंकती हैं। आवारा कुत्ते दुकानों के फालतू मांस के टुकड़ों को पूरे मोहल्ले में फैला देते हैं, वहीं खटाल से फेंका गया गोबर मोहल्ले में दुर्गंध फैलाता रहता है जो बारिश के साथ बह कर मोहल्ले में फैल जाता है। हालांकि मोहल्ले में नगर निगम द्वारा बनाया गया कूड़ेदान भी है पर इसका उपयोग कम ही किया जाता है।

समय पर कूड़ा उठाने से गंदगी नहीं

मोहल्ले में मुर्गे की दुकान चलाने वाला संतोष कहता है कि नगर निगम यदि समय-समय पर कूड़ा उठा ले तो गंदगी नहीं फैलेगी। संतोष की दुकान के बगल में ही मोहल्ले भर का कूड़ा फेंका जाता है जिसमें खटाल के गोबर से लेकर मिठाई की दुकान तक का कचरा शामिल है। संतोष इस बात का पूरा ध्यान रखता है कि कूड़ा सड़क पर नहीं फैले इसके लिए वह बराबर इसे सड़क किनारे इकट्ठा करता रहता है।

लोगों की जागरूकता के बिना संभव नहीं

स्वास्थ्य विभाग से सेवानिवृत्त और सरिस्ताबाद के आम बागान निवासी सभापति सिंह कहते हैं कि जब तक लोगों में सफाई के प्रति जागरूकता नहीं होगी, शहर का साफ रहना संभव नहीं है। लोगों को कूड़ा ऐसी जगह फेंकना चाहिए जहां से निगम की गाड़ी आसानी से इसे उठा सके। आम तौर पर लोग घर के पीछे कूड़ा फेंक देते हैं, जहां निगम की गाड़ी पहुंच ही नहीं सकती है।

पानी का निकास नहीं होने से परेशानी

गर्दनीबाग की रोड नंबर-1 के सरकारी आवास में रहने वाली उर्मिला देवी घर के सामने लगने वाले कूड़े के ढेर से परेशान हैं। हालांकि उनके घर का कचरा भी यहीं फेंका जाता है जो बारिश के दिनों में बह कर वापस इनके घर में चला आता है। कहती हैं निकास नहीं होने से मोहल्ले में पानी जमा रहता है। उर्मिला देवी के अनुसार मोहल्ले की सफाई और पानी के समुचित निकास की व्यवस्था करना नगर निगम का काम है।

निजी मोहल्लों की स्थिति बेहतर

यहीं की एक अन्य निवासी अंजू रानी कचरे से कुछ ज्यादा ही परेशान हैं। पिछले महीने उनका बच्चा गंदगी के कारण बीमार (पॉक्स) हो गया था। कहती हैं सरकारी मोहल्ले से ज्यादा बेहतर स्थिति निजी मोहल्लों की है। वहां गंदगी कम होती है और सभी मिल-जुल कर सफाई की व्यवस्था करते हैं।

बारिश में दो फीट तक पानी

दूसरी ओर पुंदरपुर में रहने वाली बिंदू सिंह निजी मोहल्ले में रहकर भी कम परेशान नहीं हैं। कहती हैं पुंदरपुर में बारिश के मौसम में दस-दस दिन तक लोग घर से बाहर नहीं निकल पाते हैं। उनके मोहल्ले की सड़क टूटी हुई है और बारिश के मौसम में दो फीट तक पानी जमा रहता है। ऐसे में जो जहां है वहीं रहता है। इसके लिए जरूरी है कि सड़कों का निर्माण सही ढंग से हो और पानी के निकास की समुचित व्यवस्था हो।

कूड़ेदान का उपयोग करना चाहिए

गर्दनीबाग, रोड नंबर-1 की रहने वाली नलिनी सिंह पिछले तीन माह से यहां रह रही हैं। कहती हैं कि गंदगी में कौन रहना चाहेगा। शुरू में खबर करने पर नगर निगम के लोग कचरा उठा कर ले जाते थे पर अब पड़ा रहता है। कहती हैं निजी मोहल्ले में रहने वाले लोगों को ऐसी मुसीबतों से कम जूझना पड़ता है।

Close shave for IA passengers

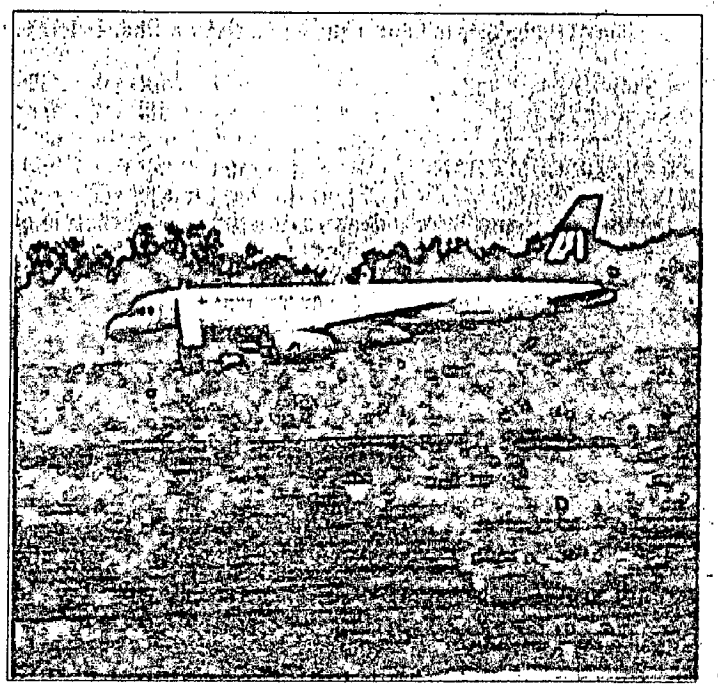
Subodh Mishra
Patna, July 12

PASSENGERS OF the Mumbai-Delhi-Ranchi-Patna-Delhi Indian Airlines flight IC 809 had a miraculous escape when the nose wheel of the aircraft got jammed after landing on the tarmac of the Jayaprakash Narayan airport here on Saturday.

The plane, which landed at 2.24 pm, could not complete its full run on the runway, as it hurtled to a stop on the airstrip. The 68 passengers on board the aircraft panicked and some of them even ejected through the emergency exit. Ladders were rushed and passengers were evacuated almost immediately. The aircraft lay stranded right in the middle of the airstrip, disrupting flight schedule for the day. All to and fro flights were suspended. The S2-115-Delhi-Patna-Varanasi-Delhi flight failed to take off while SA-2234-Mumbai-Patna-Ranchi could not land.

Civil Aviation sources said the pilot reported that the nose wheel of the plane got jammed while it was taxing on the runway after a safe landing. They said as soon as the fault developed in the wheel, the plane gave enormous jerks and passengers panicked.

Airport Director U. N. Singh claimed the plane landed safely and all passengers and crew were safe. He said since the airport did not have the tow bar system for towing away stranded aircraft from the airstrip, he had sought help from Delhi and Kolkata airports. The system would be first sent to either Ranchi or Varanasi airport and then would be brought to Patna by road.



Indian Airlines flight IC 809 stranded at the Patna airport on Saturday.

Singh said technical experts would inquire into the reason behind the snag. Engineers would be pressed into service to repair the fault and normal traffic was likely to be restored either later tonight or on Sunday morning.

Sources said bird-hit was the main reason for getting the nose wheel of the aircraft jammed. They said the incident alarmed the District Magistrate and other senior police officers, who were busy monitoring the counting of Council elections at the Bankipore Girls' High School. Magistrates were rushed to the airport to take stock of the situation. The DM also spoke to the airport authorities about the incident.

In fact, such incidents have been common at the Patna airport. On July 8, a major tragedy was averted when the pilot of Ranchi-Patna flight IC 809 managed to land the aircraft successfully after the cockpit glass panel was found smashed. The pilot had actually noticed the trouble when the plane was about to land at the airport. Significantly, Minister of State for External Affairs. Digvijay Singh was also aboard the plane.

It may be recalled that on July 17, 2000, several lives were lost when a passenger aircraft of the Alliance Air crashed in Gardanibagh colony.

Hindustan Times

प्रदूषण फैला[illegible] क खिलाफ कार्रवाई तेज

पटना (हि.प्र.)। जैव चिकित्सीय अपशिष्ट को हानिकारक तरीके से नष्ट करने वाली उन छोटी इकाइयों को हानिरहित तरीके से कचरा नष्ट करने की सुविधा उपलब्ध कराने की बिहार राज्य प्रदूषण नियंत्रण पर्षद् की योजना है। हालांकि इसके लिए किये जा रहे प्रयासों के बावजूद 639 में से मात्र 223 ऐसी इकाइयों ने ही इसके लिए पर्षद के पास आवेदन किया है जबकि इसके लिए निर्धारित अंतिम तिथि बीते वर्ष के अंतिम माह में बीत चुकी है। इनमें क्लिनिक, डिसपेंसरी, पैथोलॉजिकल प्रयोगशालाएं, रक्त बैंक आदि वैसी इकाइयां शामिल हैं जहां प्रतिमाह एक हजार या इससे अधिक मरीजों का उपचार किया जाता है, लेकिन कचरे को नष्ट करने की कोई सुविधा नहीं है। कुशल प्रबंधन के माध्यम से चिकित्सीय अपशिष्ट को नष्ट करने की सुविधा रहित उन 93 इकाइयों को पर्षद् ने कानूनी नोटिस दी है जिन्होंने आवेदन ने देकर नियमों की अवहेलना की है। इसके साथ ही 12 इकाइयों को समयबद्ध कारण बताओ नोटिस जारी कर कहा गया है कि उनकी इकाइयों को कानून की अवहेलना करने के आरोप में क्यों न बंद करने का निर्देश दिया जाए। जीव चिकित्सा अपशिष्ट (प्रबंध और हस्तन) नियम 1998 के तहत बिहार राज्य प्रदूषण नियंत्रण पर्षद् राज्य की इन इकाइयों पर कार्रवाई कर रही है। राज्य में ऐसी कई इकाइयां हैं जो जैव चिकित्सा अपशिष्ट के रूप में,स्वास्थ्य के लिए हानिकारक कचरे का उत्सर्जन कर बड़े पैमाने पर प्रदूषण फैला रही हैं। कचरे को नष्ट करने की सुविधा रहित उन इकाइयों के खिलाफ बिहार राज्य प्रदूषण नियंत्रण पर्षद कड़ी कार्रवाई कर रहा है। इनमें 500 से अधिक बिस्तर क्षमता वाले बड़े अस्पतालों और 50 से कम बिस्तर वाले नर्सिंग होम भी शामिल हैं। बड़े अस्पतालों को इन्सिनिरेटर, ऑटोक्लेव, माइक्रोवेव सिस्टम आदि सुविधाओं से सुसज्जित होना आवश्यक है।

● छोटी इकाइयों को संयुक्त प्रबंधन के माध्यम से प्रदूषणमुक्त करने की योजना

जबकि ऐसी सैकड़ों इकाइयों को प्रयोग के तौर पर संयुक्त प्रबंधन के माध्यम से अन्यत्र कचड़ा नष्ट करने की स्वीकृति दिये जाने की योजना है, लेकिन कचरे को नष्ट करने की कोई सुविधा नहीं है। पर्षद ने ऐसी इकाइयों से संयुक्त प्रबंधन के माध्यम से कचड़े को नष्ट करने की स्वीकृति प्राप्त करने को कहा था। इसके तहत छोटी इकाइयां को बड़े अस्पतालों में कचरा नष्ट करने की अनुमति होगी। बशर्ते वहां चिकित्सीय कचरा नष्ट करने की बेहतर सुविधा उपलब्ध हो तथा वहां तक हानिरहित तरीके से कचरा ले जाना आसान हो। बीते वर्ष 31 दिसम्बर की अंतिम तिथि तक हालांकि इनमें से मात्र 223 इकाइयों ने ही इसके लिए आवेदन किया। पर्षद ने इनमें से कुल 94 इकाइयों को परीक्षण के तौर पर एक वर्ष के लिए इस व्यवस्था के तहत जैव चिकित्सीय कचरे को नष्ट करने की स्वीकृति दे दी है। 129 इकाइयों के आवेदन की जांच की जा रही है। पटना स्थित इंदिरा गांधी आयुर्विज्ञान संस्थान में इस वर्ष फरवरी माह तक इस तरह की सुविधा उपलब्ध करा दी जाएगी। इसके बाद जैव चिकित्सा अपशिष्ट के रूप में प्रदूषण फैलाने वाली राजधानी की कई छोटी इकाइयां यहां कचरे को हानिरहित तरीके से नष्ट कर सकेंगी।

पटना, शुक्रवार, 05 मार्च, 2004 3

www.hindustandaily.com

प्लास्टिक, टायर और फोम जलाना कैंसर को दावत

पटना (हि.प्र.)। शहर में होलिका दहन का नजारा नजदीक से देखने वाले कैंसर को आमंत्रित कर सकते हैं। अगजा का ऐतिहासिक और पारंपरिक रूप भयावह रूप ले सकता है। लकड़ी के साथ अगर होलिका दहन में आप पुराने टायर, प्लास्टिक की थैलियों, रबड़, टायर, ट्यूब, फोम या बोतलों को जलाने जा रहे हैं तो ये पूरे पर्यावरण के लिए खतरनाक है। शहर में लकड़ी और पुआल की जगह इन चीजों का प्रयोग धड़ल्ले से हो रहा है। पर्यावरणविद् ई. राकेश कुमार के अनुसार प्लास्टिक आदि जलाने से डायक्सीन और फेरॉन जैसी व्यर्थ जहरीले पदार्थ उत्सर्जित होते हैं। इन जहरीले कम्पांउड से टॉक्सीसिटी, बायोएकुमुलेशन, म्यूजिनिसीटी और कैंसरस की उपस्थिति के कारण पर्यावरण प्रदूषक के रूप में जाने जाते हैं।

● अगजा के बाद बची राख भी वातावरण के लिए खतरनाक

डायक्सीन और फेरॉन शरीर के वसा उत्तकों में जमा हो जाते हैं। ये खाद्य श्रृंखला के द्वारा पेड़ पौधों से होते हुए जीव जंतुओं और यहां तक कि मनुष्य के शरीर में भी प्रवेश कर जाते हैं। ये आसानीसे अपघटित होते सो इनका प्रभाव बढ़ता जाता है। एक शोध में देखा गया है कि जिस क्षेत्र में क्लोरिनेटेड प्लास्टिक जलाई गई उस क्षेत्र में 90 प्रतिशत डायक्सीन की मात्रा बढ़ गई। यहां तक कि उसकी राख में भी काफी डायक्सीन पाया गया। डायक्सीन की कम मात्रा भी वातावरण में घातक परिणाम दे सकते हैं। यानी अगजा के बाद बची राख भी वातावरण के लिए खतरनाक साबित हो सकती है। श्री कुमार के अनुसार ये रसायन भविष्य में कैंसर जैसी बीमारी को भी आमंत्रित करते हैं।

कचरा निपटारे में लापरवाह अस्पतालों की अब खैर नहीं

पटना (का.सं.)। चिकित्सीय कचरे के निपटारे में लापरवाही बरतने वाले अस्पतालों पर राज्य प्रदूषण नियंत्रण पर्षद की टेढ़ी नजर है। अस्पतालों पर शिकंजा कसने की तैयारी चल रही है। राजधानी के लगभग 100 चिकित्सालयों को नोटिस जारी कर दिया गया है। गुपचुप तौर से जांच की जा रही है। लापरवाह चिकित्सालय प्रबंधकों के

● प्रदूषण नियंत्रण पर्षद ने एक सौ अस्पतालों को जारी किया नोटिस

खिलाफ अगले माह तक कार्रवाई शुरू की जा सकती है। चिकित्सालयों से उत्पन्न संक्रमित कचरे का व्यवस्थित निपटान करने के बजाय सड़कों, पार्कों या नदियों में फेंकने वाले अस्पताल राज्य प्रदूषण नियंत्रण पर्षद के निशाने पर हैं। कचरा निपटान में लापरवाही बरतने और इंसिनरेटर न लगाने वाले अस्पतालों का कच्चा चिट्ठा पर्षद ने एकत्र कर लिया है। सूत्र बताते हैं कि राज्य के विभिन्न अस्पतालों पर पर्षद 6 महीने से नजर रख रहा था। कचरा निपटान में नियम पर खरा न उतरने वाले लगभग 100 अस्पतालों को नोटिस जारी कर दिया गया है। कार्रवाई शुरू करने के लिए अस्पतालों में किए गए कचरा निपटान तरीकों की जांच की जा रही है। विश्वस्त सूत्रों के मुताबिक अब तक की जांच में चार दर्जन से अधिक अस्पताल जीव चिकित्सा अपशिष्ट नियंत्रण कानून के लपेटे में आ चुके हैं। दोषी अस्पताल प्रबंधकों के खिलाफ पर्षद अगले माह तक कार्रवाई शुरू कर सकता है।

नियम के तहत राज्य के विभिन्न अस्पतालों में कचरा निपटारे संबंधी निर्देश जारी किए गए थे। इसके तहत विभिन्न स्तर के चिकित्सालयों में कचरा निपटारे के लिए इंसिनरेटर्स, आटोक्लेव व माइक्रोवेव प्रणाली अपनाए जाने के निर्देश जारी किए गए थे। अस्पतालों कचरे के निपटान में नियम का उल्लंघन करने वाले चिकित्सालय प्रबंधकों पर पर्यावरण संरक्षण अधिनियम 1986 की धारा 15 के अंतर्गत 5 वर्ष की कैद व 1 लाख रुपए तक का जुर्माना किया जा सकता है। गौरतलब है कि जीव चिकित्सा अपशिष्ट अधिनियम लागू होने के बाद अब तक राज्य के कुछ गिने-चुने अस्पतालों ही जीव कचरे के निपटारे को लेकर कुछ हद तक सचेत हुए हैं।

पीएमसीएच का कचरा इंसीनेटर में जलाने का निर्देश

पटना (हि.ब्यू.)। सभापति प्रो. जाबिर हुसेन ने सरकार को पीएमसीएच के कचरों की नियमित सफाई और उन्हें इंसीनेटर में ही जलाने का निर्देश दिया है। मंगलवार को विधान परिषद में यह मुद्दा प्रतिपक्ष के नेता गंगा प्रसाद ने उठाया। चिकित्सा शिक्षा राज्यमंत्री शीतल राम ने कहा कि पटना के इंदिरा गांधी आयुर्विज्ञान संस्थान (आईजीआईएमएस) को अखिल

● आईजीआईएमएस को एम्स का दर्जा देने पर अभी फैसला नहीं

भारतीय आयुर्विज्ञान संस्थान (एम्स) के समरूप बनाने पर कोई ठोस फैसला नहीं हो पाया है।

राज्यमंत्री ने माना कि पीएमसीएच का प्रदूषित कचरा रोज पोस्टमार्टम रूम के सामने ही फेंक दिया जाता है। लेकिन उन्होंने कहा कि दवाओं के अवशेष, पोस्टमार्टम से निकले प्लीसेंटा और अन्य कचरों को इंसीनेटर से ही जलाया जाता है। सदस्यों ने इसका विरोध किया। उनका कहना था कि वहां जमीन पर कचरा जलाने की कोशिश की जाती है और यह हमेशा सुलगता रहता है। सभापति ने सदन की चिंता का खुलासा करते हुए कहा कि कचरे के धुएं से मरीजों को परेशानी होती है और उनके स्वास्थ्य पर बुरा असर पड़ता है। मंत्री के मशीन से ही कचरा जलाने संबंधी जवाब को कांग्रेस के महाचन्द्र सिंह ने भी चुनौती दी। उन्होंने कहा कि वे रोज उधर से गुजरते हुए धुंए को उठते हुए देखते हैं। वहां निगम, अस्पताल के कचरे और दवाओं के अवशेष के जलने से उत्पन्न होने वाले धुएं से मरीज तो क्या आमजन भी परेशान रहते हैं। अस्पताल अधीक्षक ने इस बारे में मंत्री को गलत जानकारी दी है।

राजद के नवल किशोर यादव द्वारा उठाए गए आईजीआईएमएस के मुद्दे पर मंत्री ने कहा कि जब तक अधिग्रहण की विधि और उसका स्वरूप तय नहीं होता है, तब तक एम्स के समरूप इसे बना पाना संभव नहीं है। सदस्यों के यह पूछने पर कि आखिर कब तक वार्ता चलेगी, मंत्री ने कहा कि जब तक कि केन्द्र और राज्य दोनों मिलकर इस पर निर्णय नहीं ले लेते। दो बार केन्द्र को स्मारित करने पर भी अधिग्रहण की रूप-रेखा तय नहीं हुई। समता के मंगनी लाल मंडल के गतिरोध के बिन्दु और अधिग्रहण के मानदंड के बारे में पूछे जाने पर मंत्री ने कहा कि बिहार सरकार ने अभी कुछ नहीं किया है। यह उभयपक्षीय मामला है।

निगम का 2 करोड़ के घाटे का बजट पारित

पटना (का.सं.)।नगर निगम पार्षदों ने सोमवार को चर्चा के बाद आगामी वित्तीय वर्ष के लिए दो करोड़ तीन लाख के घाटे के बजट को संशोधन की शर्तों के साथ पारित कर दिया। हालांकि सदस्यों समेत मुख्य कार्यपालक पदाधिकारी ने माना कि बजट त्रुटिपूर्ण है। पटना सिटी अंचल सभागार में बैठक के दौरान दो-दो हाजिरी बही पर हस्ताक्षर कराने को लेकर हंगामा हुआ। महापौर ने तत्काल नयी बही को जब्त कर लिया। बैठक में जल पर्षद के 1 करोड़ 95 लाख के घाटे के बजट को भी पारित कर दिया गया। निगम और जल पर्षद के अधिकारियों ने बैठक में धैर्य और संयम से काम लिया। रामकृपाल यादव ने सरकार द्वारा निगम में आयुक्त स्तर के एक और अपर आयुक्त स्तर के तीन अधिकारियों की नियुक्ति के प्रस्ताव का स्वागत किया। उनके आग्रह पर सदन ने इसे तत्काल पारित कर दिया। इसके बाद बजट पर चर्चा हुई। अधिकारियों ने बताया कि वर्ष 2003-04 के लिए 58,98,04,505 रुपये की आमदनी और 61,01,21,390 रुपये के खर्च के प्राक्कलन के साथ 2,03,16,885 रुपये के घाटे का बजट तैयार किया गया है। इतने में वार्ड नं. 25 के पार्षद आत्मानंद प्रसाद ने फर्जी हाजिरी बही पर सदस्यों से हस्ताक्षर कराये जाने का मुद्दा उठा दिया। इस पर सदन में फिर हंगामा शुरू हो गया। उप महापौर संतोष मेहता ने इसे गम्भीर मामला बताते हुए अध्यक्ष से जांच की मांग कर दी। दरअसल पुरानी हाजिरी बही कार्यकारी सचिव देवेन्द्र राय के पास थी और नयी बही पर सदस्यों से हस्ताक्षर कराये जा रहे थे। अध्यक्ष ने तत्काल नयी बही को जब्त कर लिया। पार्षद बैद्यनाथ यादव और नरेश कुमार ने बजट प्रस्ताव के मुताबिक बाढ़ में सुरक्षा के लिए 50 हजार, नये धोबी घाट के निर्माण के लिए 50 हजार और सड़कों, नालियों की मरम्मत के लिए मुख्य कार्यपालक पदाधिकारी द्वारा 20 लाख रुपये खर्च करने

● बैठक में शामिल हुए अधिकारी

फर्जी हाजिरी बही पर हंगामा

के प्रस्ताव को अनुचित बताते हुए इस पर आपत्ति व्यक्त की। उन्होंने पार्षदों को भी विकास मद में राशि का आवंटन करने की मांग की। रूपनारायण महतो ने 'प्रदीपन' शब्द पर आपत्ति उठा दी और इस मद में अगले वित्तीय वर्ष में 29,13,700 रुपये खर्च करने के प्रस्ताव को सीधे घोटाले से जोड़ दिया। बैठक के दूसरे सत्र की अध्यक्षता कर रहे उप महापौर संतोष मेहता ने सदस्यों की भावनाओं के मुताबिक बजट को त्रुटिहीन बनाने के लिए महापौर और मुख्य कार्यपालक पदाधिकारी के बीच 31 मार्च से पहले बैठक का निर्देश दिया जिसे अधिकारियों ने मान लिया। बैठक में पार्षद मंशा देवी, रणजीत कुमार सिंह, मंजू राय, मंजू देवी, रणतोष कुमार, रणजीत कुमार, मुन्ना राय, सत्यभामा सिंह, फरहत अहमद, शाहिन तबस्सुम, अर्जुन यादव, लाली देवी, जवाहर प्रसाद, कलीम इमाम, जयनारायण शर्मा, दिलीप मेहता, प्रदीप मेहता समेत अनेक पार्षद उपस्थित थे। बैठक में विधान पार्षद मो.यूनुस लोहिया जियाउल्लाह खान द्वारा उनकी किसी अनुशंसा के खिलाफ टिप्पणी पर भड़क गये और उन्होंने श्री खान के खिलाफ मानहानि का मुकदमा करने की चेतावनी दे दी। बैठक में निगम के तीनों अंचलों के कार्यपालक पदाधिकारी समेत सहायक स्वास्थ्य पदाधिकारी, लेखा पदाधिकारी भी उपस्थित थे।

मेयर का 'पावर' चल गया

आखिरकार मेयर का 'पावर' चल ही गया। सोमवार को नगर निगम की विशेष बैठक में महापौर द्वारा नियुक्त कार्यकारी सचिव डी.राय उर्फ धाकड़ राय के हस्ताक्षर से सदस्यों को भेजे गये एजेंडे पर ही चर्चा हुई और मुख्य कार्यपालक पदाधिकारी द्वारा नियुक्त सचिव शशिकांत मिश्रा 'शंट' हो गये। मुख्य कार्यपालक पदाधिकारी ने अपमान के इस कड़वे घूंट को बैठक में तो पी लिया लेकिन निलंबित मुख्य लेखा पदाधिकारी डी. राय पर खतरे की तलवार लटक गयी है।

नगर निगम के 407 सफाई मजदूरों का अता-पता नहीं

श्यामनंदन कुमार

पटना,18 नवम्बर। सफाई मजदूरों की कमी से जूझ रहे पटना नगर निगम के 407 सफाई कर्मचारी कथित रूप से लापता हो गये हैं। निगम मुख्यालय में फाइलें झाड़-पोछ कर सूची बनायी जा रही हैं कि फलां वार्ड और अंचल में इतने बूढ़े, जवान, स्त्री,पुरुष सफाई मजदूर हैं लेकिन अधिकारी परेशान हैं कि फीगर मैच नहीं कर रहा है।' अब जबकि 20 तारीख को स्थायी समिति में सफाई मजदूरों की संख्या पार्षदों के सामने रखी जानी है, तो अधिकारी माथा धुन रहे हैं। सूची बनाये जाने के दौरान ही यह भी खुलासा हो रहा है कि कितने मजदूरों को मनमाने ढंग से कहीं बैठाकर वेतन दिया जा रहा है या उनके नाम पर वेतन हड़पा जा रहा है। ज्ञात हो, निगम के कर्मचारी संगठनों ने कई बार निगम मुख्यालय को इस बारे में शिकायतें भेजी हैं कि सैकड़ों फर्जी सफाई मजदूरों के वेतन के नाम पर लाखों की राशि हर महीने अधिकारियों द्वारा डकार ली जाती है। निगम पार्षद सबसे ज्यादा सफाई मजदूरों के बंटवारे से आक्रोशित हैं और उनकी कमी से परेशान भी। दरअसल निगम में सफाई मजदूरों का गणित इतना उलझा हुआ है कि इस पेंच को सुलझाना आसान नहीं। अगर इसे तमाम अनियमितताओं की जड़ कहा जाये तो गलत नहीं होगा।

- अधिकारी माथा धुन रहे , फीगर मैच नहीं कर रहा
- पार्षदों का आरोप : सही जानकारी तक नहीं दी जाती

सूत्रों ने बताया कि वर्तमान में 2509 सफाई मजदूर हैं। उनमें से कुछ पढ़े-लिखे 265 मजदूर सफाई कार्यों से अलग हैं। उन्हें या तो प्रभारी सफाई पर्यवेक्षक, यहां तक कि निरीक्षक बना दिया गया है या वे अन्य कार्यों में मशरूफ हैं। शेष बचे 2244 लेकिन वार्डों में बंटवारा हुआ 2092 मजदूरों का। फिर भी 142 मजदूरों की कमी रह जाती है। यानी ज्ञात-अज्ञात मजदूरों की संख्या 407। अब अधिकारी मिलान कर रहे हैं कि इतने सफाई मजदूर मंत्री, अधिकारी एवं अन्य महत्वपूर्ण लोगों के यहां, इतने श्मशान घाट पर, इतने मुख्यालय में और इतने विशेष गैंग में, इतने फलां-फलां के यहां। कमबख्त संख्या फिर भी पूरी नहीं हो पा रही है।

जानकारी के अनुसार पूर्व में स्वीकृत मजदूरों की संख्या 2718 थी। उसके बाद दो चरणों में क्रमश: 389 और 333 मजदूरों की बहाली हुई थी। यह संख्या 3440 होती है। समय बीतने के साथ-साथ मजदूर सेवानिवृत्त होते गये। बच गये 2509 मजदूर।

उसमें भी घपला! पिछले दिनों निगम बोर्ड की बैठक में विधान पार्षद और पूर्व उप महापौर रामकृपाल यादव तथा निगम पार्षद प्रदीप मेहता ने भी इस मुद्दे को गरमाया था। श्री यादव ने बोर्ड की बैठक में कहा कि 1069 सफाई कर्मचारियों की नियुक्ति वैधता जांच मुख्यमंत्री के आदेश से चल रही है। उनकी जानकारी के अनुसार उसमें से 60 प्रतिशत बहाली फर्जी है।

बिहार राज्य जल पर्षद के प्रबंध निदेशक की अध्यक्षता में बनी जांच कमेटी,जिसके सदस्य निगम के मुख्य कार्यपालक पदाधिकारी और पटना क्षेत्रीय विकास प्राधिकार के उपाध्यक्ष हैं,ने अभी तक अपनी रिपोर्ट सरकार को नहीं दी है। मु.का.पदा. बताते हैं कि 1069 सफाई मजदूरों में से 889 के बारे में जो जानकारी मुख्यालय में थी, वह जांच कमेटी को भेज दी गयी है।

शेष 180 सफाई मजदूरों के बारे में कोई जानकारी मुख्यालय को नहीं है। हद तो तब हो गयी जब निगम बोर्ड की बैठक में उपस्थित मुख्य कार्यपालक पदाधिकारी अरुणभूषण प्रसाद भी सफाई मजदूरों की सही संख्या के बारे में जानकारी नहीं दे सके। पार्षदों का गुस्सा इस बात को लेकर है कि मुख्यालय से एक तो सफाई मजदूरों की सही सूची नहीं मिलती है,उस पर संख्याबल की कमी का बहाना बनाकर मनमाने तरीके से उनके वार्डों में सफाई मजदूरों को भेज दिया गया। वार्ड नम्बर 7 के पार्षद रंजीत कुमार सिंह ने निगम अधिकारियों पर आरोप लगाया कि उन्होंने पोल खुलने के डर से पार्षदों को सफाई मजदूरों के मुद्दे पर भ्रम में रखा है।

नगर

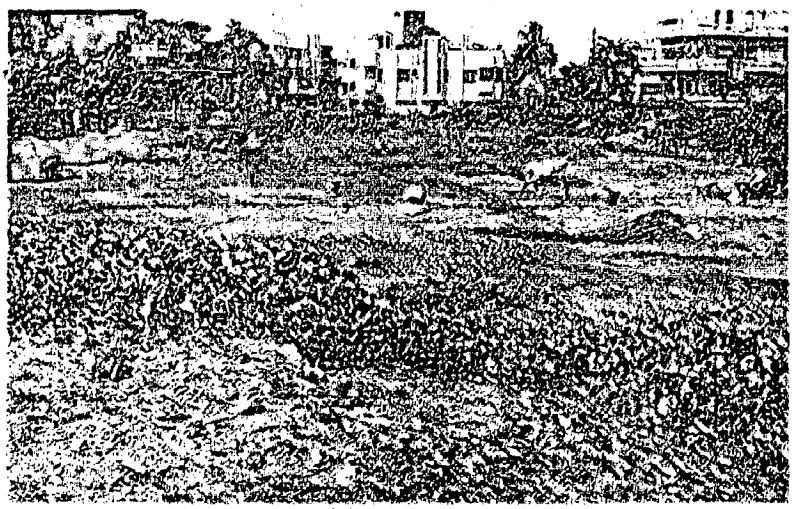
आर ब्लाक चौराहा : सफाई हो गई

यारपुर रोड न. 10 : कब बहुरेंगे दिन

आर ब्लाक चौराहा के पास तो सफाई हो गई लेकिन यारपुर के रोड न. 10 की किस्मत में अभी सफाई का मुहूर्त नहीं निकला है

छाया: हिन्दुस्तान

ये देखिए पटना के पार्क



यह चिल्ड्रेंस पार्क है या खटाल! फैसला पाठकों पर

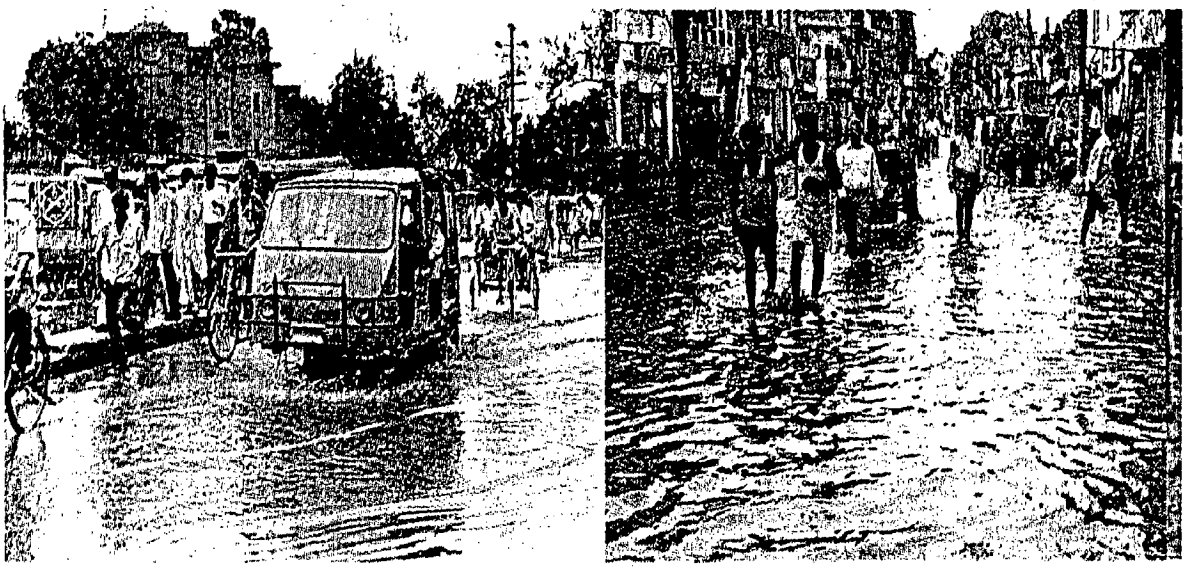
छाया : दीपूराज

ऐसा है संजय गांधी चिल्ड्रेन्स पार्क!

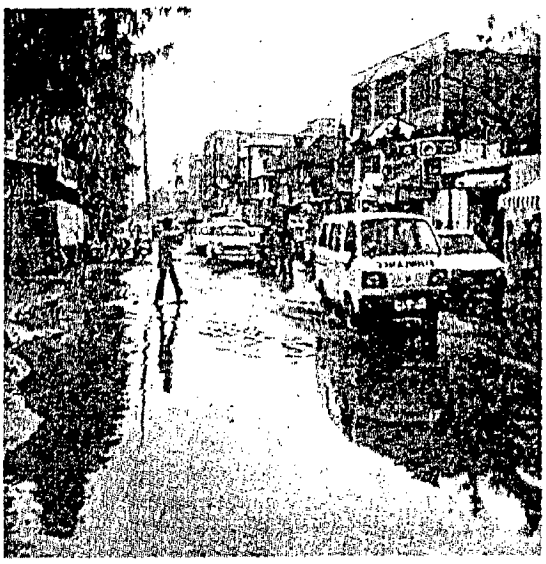
पटना (हि.प्र.)। बच्चों के खेलने की जगह और कब्जा है खटाल मालिकों का। यह नजारा है है श्रीकृष्णनगर स्थित संजय गांधी बाल उद्यान का। कभी गुलाब, गेंदा, बेली और डहेलिया से सजे रहने की परिकल्पना वाले इस उद्यान की पहचान अब कंटिली झाड़ियों और कूड़े के अंबार से होती है। कुछ वर्ष पूर्व पार्क से अतिक्रमण हटा कर बच्चों के खेलने की जगह तैयार करने का प्रयास किया गया लेकिन बात नहीं बनी। नगर निगम की उदासीनता के कारण अतिक्रमणकारी फिर आ जमे। अब स्थिति यह है कि पार्क के दक्षिण-पश्चिम की चहारदीवारी पूरी तरह ढह गई है। तो कई जगहों पर लोहे के लगे ग्रिल को भी चोरों ने उड़ा लिया। चहारदीवारी ढहने के बाद अब खाली जगह पर आसपास के निजी स्कूलों की बसें खड़ी की जा रही है। इस हालत में श्रीकृष्णनगर के बच्चे खेलने के लिए कहां जाए? इसका जवाब किसी के पास नहीं।

माली हाकिमों की सेवा में, पार्कों का सत्यानाश

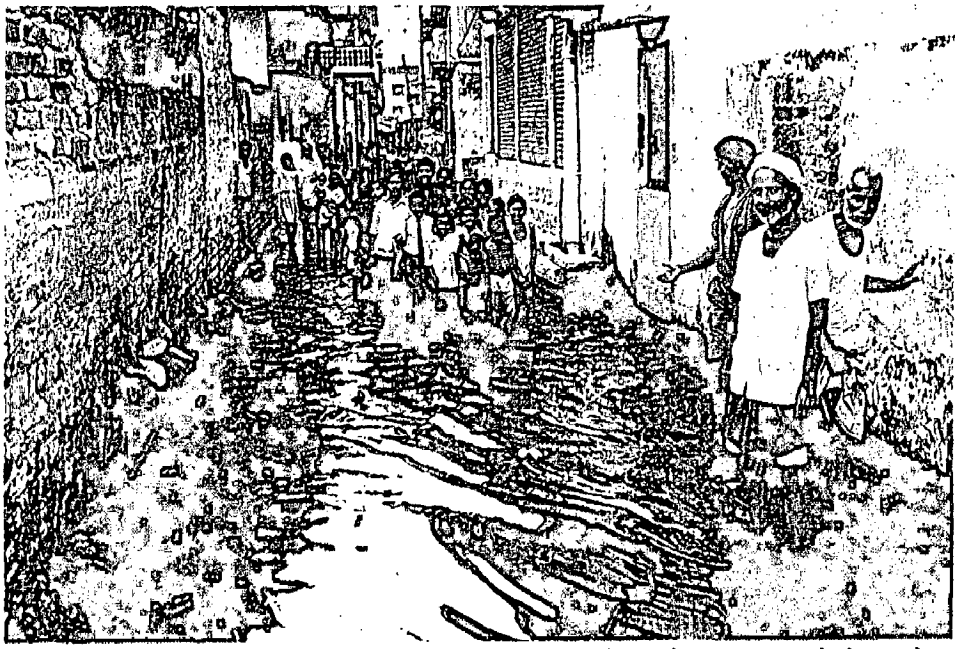
विद्यालयों की स्थिति



ढाक के तीन पात ! लाख कवायद के बाद भी राजधानी की सड़कों और नालों की सूरत नहीं बदली। ठाकुरबारी रोड और बोरिंग रोड में सड़क पर अटके पानी ने बरसात



से निपटने की नगर निगम की तैयारियों की पोल खोल दी *छाया : हिन्दुस्तान*



ध्यान से देखिए यह अपने चिरैयाटांड़ मोहल्ले का बंगाली टोला रामनगर ही है : रास्ते पर जल भराव से परेशान लोग

...मगर प्रदूषण नियंत्रण के लिए लाचार नगर निगम क्या करे?

यांत्रिक संसाधन जुटाने के लिए निगम को 13.60 करोड़ रुपए चाहिए लेकिन पैसे कहां हैं, पर्याप्त कर्मचारी तक नहीं

पटना (का.सं.)। गधे पर सवा मन का बोझ तो ठीक, सवा सौ मन का बोझ कैसे उठाएगा नगर निगम। लगभग 18 लाख की स्थाई और अस्थाई आवादी से प्रतिदिन इकट्ठा होनेवाले लगभग 800 टन कूड़े का निष्पादन यांत्रिक एवं मानव संसाधनों की घोर कमी से जूझ रहे नगर निगम के लिए पहाड़ को समतल करने के समान है। निगम के पास चलते सफाई कर्मचारी तक नहीं हैं। जो हैं उनमें एक तिहाई अक्षम और बेकार और तिहाई संसाधनों के बलबूते ही सफाई का जिम्मा उठाये हुए हैं। 1952 में स्थापना काल के वक्त निगम क्षेत्र की आबादी मात्र दो लाख थी जबकि सफाई मजदूर थे 37 सौ। आज आबादी तथा क्षेत्र में सात से आठ गुना बढ़ोतरी के बाद सफाई मजदूर वचे सिर्फ 2070 यानी औसतन 800 नागरिकों की आबादी पर एक सफाई मजदूर। उसमें से भी लगभग एक चौथाई अक्षम मजदूरों को हटाना संभव नहीं है तथा नये मजदूरों को बहाली निगम की आर्थिक सेहत के लिए कांढ़ में खाज को तरह है।

वैसे निगम ने आवश्यकतानुरूप वाहनों की खरीद के लिए 15 करोड़ की योजना बनायी है; यूनाइटेड स्टेट्स एजेंसी फॉर इंटरनेशनल डेवलपमेंट की रिपोर्ट के अनुसार सिर्फ यांत्रिक संसाधन जुटाने के लिए निगम को 13.60 करोड़ रुपए चाहिए लेकिन इसके लिए निगम के प्रयास नाकाफी हैं। सुप्रीम कोर्ट के आदेशानुसार शहर को सूरत पूर्वोभ्यास को पुद्दा में भी खड़ा होने को स्थिति में नहीं है।

संवादी में लाचार निगम अपनी कार्यक्षमता और कार्यसंस्कृति में बदलाव के लिए विभिन्न सूत्रों के अनुसार राजधानी में इकट्ठा होनेवाले कूड़े में से 54 प्रतिशत घरेलू , 31 प्रतिशत व्यावसायिक, 2 प्रतिशत अस्पतालजनित तथा 13 प्रतिशत औद्योगिक तथा निर्माणजनित कचरा होता है। निगम अपने संसाधनों का पूरा उपयोग कर लगभग 450 टन कूड़ा साफ कर पाता है। निगम का रोना यह है कि वह प्रतिदिन इकट्ठा होने वाला इतना कूड़ा कहां फेंके। सरकार ने बिना मुआवजा दिये आज से कई दशक पहले इसको 71 एकड़ जमीन अधिगृहित कर ली।

बार बार आग्रह किए जाने पर जून में जिला प्रशासन ने कूड़ा निष्पादन केंद्र के लिए राष्ट्रीय उच्च पथ पर पहाड़ी के नजदीक 47.62 एकड़ जमीन देने की कार्रवाई शुरू की है। जमीन अधिग्रहण के लिए सरकार ने 9 करोड़ रुपए की मंजूरी दी है।

नूतन राजधानी अंचल		बाकीपुर अंचल	पटना सिटी अंचल	कुल
ट्रैक्टर (कार्यरत)	24	20	18	62
(बेकार)	22	1	23	46
टीपर (कार्यरत)	11	2	3	16
(बेकार)	4	6	1	11
पेलोडर (कार्यरत)	2	1	1	4
(बेकार	4	4	5	13
पम्प (कार्यरत)	8	-	-	8
(बेकार)	18	-	609	18
सफाई मजदूर	821	602		2063

जिला प्रशासन सूत्रों के अनुसार लैंडफिल के लिए जमीन अधिग्रहण की प्रक्रिया चल रही है और जनवरी से जमीन मालिकों को नोटिस भेजा जाने लगेगा। यांत्रिक संसाधनों के रूप में अभी निगम के तीनों अंचलों में 121 ट्रै क्टर, ट्रेलर, 17 पे-लोडर, 7 डम्पर, 27 टीपर, बड़े नालों की उड़ाही के लिए 2 फोकलेन, मच्छर भगाने के लिए तीन बड़ी तथा 10 छोटी फौगिंग मशीनें तथा डीजलचालित पम्प हैं। इनमें से 50 ट्रैक्टर, 13 पे-लोडर, 7 डम्पर, 11 टीपर, 18 डीजलचालित पम्प तथा 10 छोटी एवं दो बड़ी फौगिंग मशीनें बेकार हैं। कई वाहन तो मरम्मत में भारी खर्च के कारण बेकार हो गये हैं। सफाई मजदूरों की स्थिति भी इससे भिन्न नहीं है। निगम में अभी कुल 3379 कर्मचारी, अधिकारी हैं जबकि आवश्यकता कम से कम दस हजार कर्मचारियों की है। वर्तमान में निगम में 2507 सफाई कर्मचारी हैं। इनमें से 438 सफाई के अलावा दूसरे कार्यों में लगे हैं। कहीं ये कर वसूली कर रहे हैं तो कहीं लिपिकीय कार्यों में भी लगे हैं। शेष 2063 सफाई मजदूरों में से लगभग 400 अधिक उम्र के हैं जो किसी तरह ड्यूटी बजा रहे हैं या अक्सर बीमार रहते हैं।

कुल सफाई मजदूरों में से एक तिहाई अक्षम हैं जिनसे निगम पूरा काम भी नहीं ले पाता है और उनका वेतन भुगतान निगम में भ्रष्टाचार का बड़ा स्रोत भी है। निगम प्रशासन ने बढ़ती आवश्यकताओं के अनुरूप वाहनों को खरीद के लिए 15 करोड़ की योजना बनायी है। इसके तहत 57 ट्रैक्टर, 25 टीपर, 10 पे-लोडर, ट्रेलर पर स्थित 10 सक्शन मशीन तथा 10 जेटिंग मशीन, मिनी ट्रक पर स्थित 5 जेटिंग मशीन, 5 संयुक्त जेटिंग एवं सक्शन मशीन, 5 छोटा एक्सकेवेटर, 35 डम्पर, 4.5 क्यूबिक मीटर के 100 बंद कंटेनर तथा 3.5 क्यूबिक मीटर के 150 कंटेनर, कूड़ा ढोने के लिए 1000 हाथ गाड़ी, 3 फौगिंग मशीन, 5 अश्वशक्ति के 57 तथा 10 अश्वशक्ति के 57 डीजलचालित पम्प सेट खरीदने के लिए 14.43 करोड़ तथा वाहनों के रखरखाव के लिए 50 लाख का शेड बनवाने की योजना बनायी गयी है। हालांकि पूर्व चीफ अरुणभूषण प्रसाद ने सफाई के निजीकरण के तहत क्षेत्र को 24 में से 10 प्रधान मुख्य सड़कों की सफाई के लिए 76 लाख भुगतान का प्रस्ताव सरकार को भेजा था। श्री प्रसाद के स्थानांतरण के बाद इस प्रस्ताव के बारे में कोई बात भी नहीं करना चाहता।

शहरी कचरा प्रबंधन पर कार्यशाला शुरू

पटना (का.सं.)। शहरी कचरे का उचित प्रबंधन नगरपालिकाओं के समक्ष गंभीर चुनौती बन चुकी है। कूड़ा को ठिकाने लगाना तकनीकी विकास के साथ-साथ जनचेतना जागृत करने से ही संभव है। ये बातें इंस्टीच्यूशन ऑफ इंजीनियर्स के सतत विकास मंच के अध्यक्ष प्रो. जी.पी.लाल ने कहीं। अभियांत्रिकी एवं पर्यावरण की संस्थाओं के विश्व परिसंघ के अध्यक्ष प्रो. लाल रविवार को यहां सतत शहरी कूड़ा प्रबंधन पर आयोजित कार्यशाला में बोल रहे थे। इंस्टीच्यूशन ऑफ इंजीनियर्स ने लखनऊ स्थित क्षेत्रीय शहरी एवं पर्यावरण अध्ययन केंद्र के साथ इसे आयोजित किया है। उन्होंने कहा कि आधुनिक तरीके से कूड़ा संग्रहण और निपटान के लिए राज्य तकनीकी मिशन के गठन की आवश्यकता पर जोर दिया।

प्रो. लाल ने कहा कि राष्ट्रीय पर्यावरण अभियांत्रिकी अनुसंधान संस्थान, नागपुर के सर्वेक्षण के मुताबिक शहरों का 4 से 7 प्रतिशत प्रति वर्ष की दर से विकास हो रहा है। इसी रफ्तार से शहरी कूड़ा भी बढ़ रहा है जिसका निपटारा शहरी स्थानीय निकाय कई कारणों से सही ढंग से नहीं कर पा रहे हैं। इससे शहरों में स्वच्छ पर्यावरण का संकट बढ़ रहा है। उन्होंने आधुनिक तरीके से कूड़ा संग्रहण के साथ-साथ निपटान की दूरगामी योजनाएं बनाने के लिए राज्य तकनीकी मिशन गठित करने, केंद्र तथा राज्य सरकारों द्वारा आर्थिक एवं तकनीकी मदद देने, क्षेत्रीय विकास

● राज्य तकनीकी मिशन बनाने की मांग

प्राधिकारों द्वारा कूड़ा प्रबंधन के लिए कम से कम 20 वर्षों के उपयोग लायक जमीन अधिग्रहण पर जोर दिया। लखनऊ स्थित अध्ययन केंद्र के डा. यू.बी.सिंह ने कहा कि नगर निकायों को न सिर्फ ठोस अवशिष्ट बल्कि औद्योगिक, रासायनिक, अस्पताल जनित कचरे के प्रबंधन को भी समेकित ढंग से अपनाना होगा। पटना विवि के सेवानिवृत्त प्राध्यापक प्रो. संतोष कुमार ने शहर स्वच्छता अभियान में गैर सरकारी संस्थाओं की अहम भूमिका देने की आलोचना की और इसे करदाताओं के साथ ज्यादती तथा नगर निकाय प्रशासन की विफलता बताया। भारतीय मानक ब्यूरो के श्री ए.के. सेन ने शहरों का पर्यावरण स्वच्छ रखने के लिए पर्यावरण संरक्षण कानूनों को सख्ती से लागू करने पर जोर दिया। कार्यशाला को संयोजक एवं सूबे के पूर्व मुख्य नगर योजनाकार एस.के. सिन्हा, पटना विवि के प्रति कुलपति प्रो. जीतेन्द्र सिंह, डाल्फिन प्रोजेक्ट के समन्वयक प्रो. आर.के. सिन्हा, राज्य प्रदूषण नियंत्रण पर्षद के सदस्य सचिव इन्दूशेखर सिंह, श्रीमती ऋचा विरमानी, अभियंता एस.सी. श्रीवास्तव, जी.एस. श्रीवास्तव, ए.एन. कॉलेज के पर्यावरण विज्ञान के छात्रों सुशान्त कुमार सिंह, अजय कुमार लाल, फुलवारीशरीफ नगर पंचायत के अध्यक्ष आफताब आलम, उपाध्यक्ष चित्तरंजन पासवान, फतुहा नगर पंचायत के सदस्य कृष्णा प्रसाद सिंह ने भी संबोधित किया।

अनिसाबाद पहाड़पुर मुख्य सड़क पर जल जमाव जागरण

होटल मौर्या के सामने लगा गंदगी का अंबार जागरण

कंकड़बाग टेम्पो स्टैण्ड के पास का दृश्य जागरण

कंकड़बाग सब्जी मंडी का नजारा जागरण

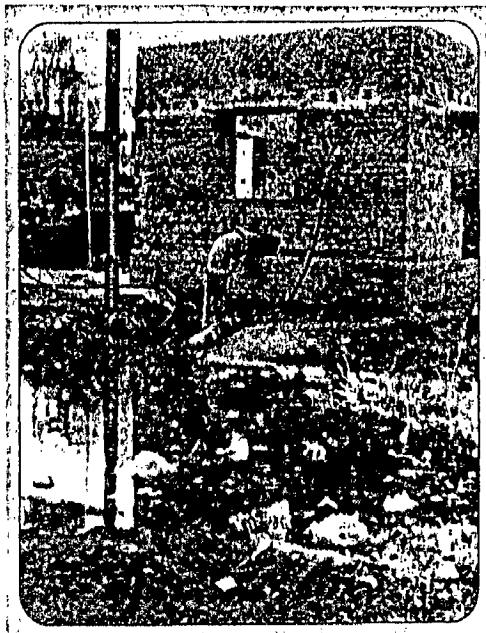
असर नहीं दिख रहा अभियान का

पटना, जागरण संवाददाता : उच्च न्यायालय के आदेश के बाद नगर निगम भले ही तीन पालियों में सफाई अभियान शुरू किया हो लेकिन इस अभियान से आम जनता का कोई भला होने वाला नहीं है। इसका मुख्य कारण यह है कि निगम के कर्मचारी मुख्य सड़कों पर ही सफाई का काम कर रहे हैं गलियों में न कोई टीपर जा रहा है और न ही ट्रैक्टर। शुक्रवार की सुबह बारिश हो जाने के कारण शहर की स्थिति और भी नारकीय हो गयी है। कई इलाकों में जलजमाव के कारण सड़ान्ध हो जाने से संक्रामक बीमारी फैलने का खतरा पैदा हो गया है।

सिर्फ दिखावा

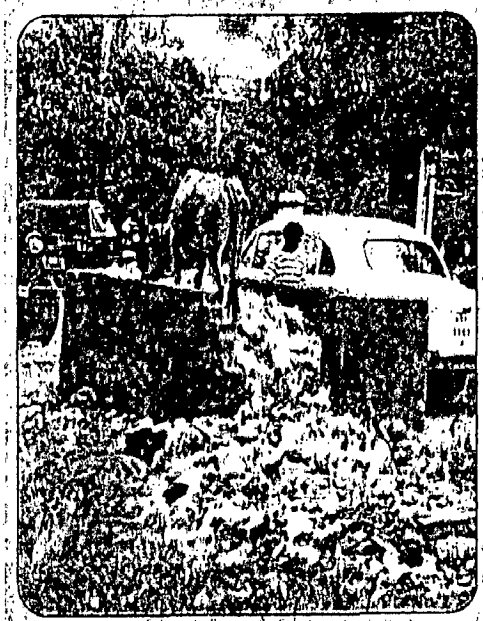
राजधानी के हीरा प्लेस की पश्चिमी गली, गांधी पथ, बुद्धाकालोनी व मंदिरी को जोड़ने वाली सड़क पर, साधनापुरी के रोड नम्बर 6 डी में स्थित दुकानों के पीछे, गर्दनीबाग के रोड नम्बर 16 पर ठाकुरबाड़ी मंदिर के पूर्व और पश्चिम दोनों ओर, बलदेव भवन के पीछे पंचवटी अपार्टमेंट रोड से लेकर अन्नपूर्णा अपार्टमेंट के बगल के बाबा लाज तक कूड़ों का अम्बार महीनों से लगा हुआ है। इन इलाकों के नागरिकों ने बताया कि निगम को कूड़ों के जमाव के सम्बन्ध में कई बार जानकारी दी गयी लेकिन उनके कान पर जूं तक नहीं रेंगी।

इसके अलावा राजेन्द्र नगर के रोड नम्बर 1/ 2 डी में सड़क पर पानी की टंकी के पूर्व वाली गली में काफी कूड़ा जमा हुआ है।



करबिगहिया पंप हाउस के पास गंदगी जागरण

पाटलिपुत्रा थाना के सामने का नजारा जागरण



पाटलिपुत्रा कालोनी में सहयोग अस्पताल के सामने जागरण

बैंक कालोनी दीघा के सामने का दृश्य जागरण

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Indian Standard

GLOSSARY OF TERMS RELATING TO SOLID WASTES

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Indian Standard

GLOSSARY OF TERMS RELATING TO SOLID WASTES

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(*Continued on page 2*)

(*Continued from page* 1)

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Indian Standard

GLOSSARY OF TERMS RELATING TO SOLID WASTES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 July 1980, after the draft finalized by the Solid Wastes Sectional Committee had been approved by the Chemical Division Council.

0.2 This standard has been formulated with a view to eliminating ambiguity and confusion arising from different interpretations of terms relating to solid wastes and establishing a generally recognized usage.

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1. SCOPE

1.1 This standard defines the terms commonly used in the field of solid wastes.

2. TERMS AND DEFINITIONS

A

Abrasion — Wearing away of surface material by scouring action of moving solids, liquids or gases, for example abrasion of hammers in a hammer-mill.

Actinomycetes — A large group of moldlike micro-organisms having an odour similar to that of rich earth. These organisms play an important role in composting of solid wastes.

Aeration — The process of exposing the material (solid or liquid) to air.

Aerobic — Able to live and grow only in the presence of free oxygen.

Afterburner — A device used to burn or oxidize the combustible constituents remaining in effluent gases.

Aggregate — Crushed rock or gravel prepared for use in road surface, concrete or bituminous mixes.

Air — The mixture of gases comprising the earth's atmosphere.

Air, Stoichiometric — *See* Combustion Air, Theoretical.

Air, Underfire — Air that may be forced or induced in a controlled quantity and direction and is supplied below a grate and passes through a fuel bed.

Air Deficiency — The shortage of air, as compared to theoretical combustion air in an air-fuel mixture.

Air Heater — A heat exchanger in which the flowing air is heated by hot combustion gases.

Air Jets — Streams of high velocity air issuing from a nozzle in an incinerator to provide turbulence, combustion air or a cooling effect.

Air Pollutant — A substance which when present in adequate amount adversely affects the environment.

Air Pollution — The presence in ambient atmosphere of substances, generally resulting from the activity of man, in sufficient concentration, present for a sufficient time and under circumstances to interfere significantly with comfort, health or welfare of persons or with full use or enjoyment of property.

Air Quality — The composition of air with respect to quantities of pollutants therein.

Air Quality Standards — The maximum acceptable pollutant concentration in the outside air that cannot be exceeded during a specified time in a specified area.

Alkalinity — The quantitative capacity of aqueous media to react with hydrogen ions.

Alley Collection — Removal of solid wastes from containers placed adjacent to an alley

Ambient Air — The surrounding air.

Anaerobic — Able to live and grow in the absence of free oxygen.

Analysis, Proximate — Analysis of a solid fuel to determine its moisture, volatile matter, fixed carbon and ash content. Usually the fuel's heat value is also determined.

Analysis, Ultimate — The chemical analysis of a solid, liquid or gaseous fuel. In the case of solid fuel, the amount of carbon, hydrogen, sulphur, nitrogen, oxygen and ash are determined.

Angle of Repose — The maximum acute angle that the inclined surface of a pile of loose material can make with horizontal.

Aquifer — An underground water bearing geological formation.

Arch, Furnace — A structure that extends into a furnace to deflect gases.

Arch, Ignition — A refractory furnace arch or surface located over a fuel bed to radiate heat and accelerate ignition.

Ash-Pit — A pit or hopper located below a furnace where residue accumulates before its removal.

Ash-Sluice — A trench or channel through which ash is transported by water from ash-pit to collection or disposal point.

Auxiliary Fuel Firing Equipment — Equipment used in an incinerator to supply additional heat by burning an auxiliary fuel so that the resulting higher temperature:

a) dries and ignites waste material,

b) maintains ignition, and

c) effects complete combustion of combustible solids, vapours and gases.

B

Backfill — The material used to refill a ditch or other excavation or the process of doing so.

Backhoe Tamping — A processing step in which a conventional backhoe is used to compact waste contained in an open-top transport vehicle.

Bacteria — Primitive micro-organisms, generally free of pigment, which reproduce by dividing in one, two or three planes. They occur as single cells, groups, chains, or filaments. They may be grown by special culturing out of their native habitats.

Baffle — A structure used to change direction of fluid flow.

Baffle Chamber — A chamber following the combustion chamber in which baffles change the direction of and/or reduce the velocity of combustion gases so as to promote settling of flyash or coarse particulate matter.

Baffle, Water-cooled — A baffle composed mainly of closely spaced boiler tubes.

Bagasse — Fibrous residue remaining after juice is extracted from sugarcane or sugar beets.

Baler — A machine used to compress and bind solid waste or other material.

Bangalore Process — An anaerobic composting process in which refuse and human excreta are put in alternate layers in a pit which is finally covered by a thick soil layer.

Bearing Capacity — The maximum load that a given material can support before failing.

Beccari Process — A process developed by Dr Beccari in 1922. In this process, anaerobic fermentation is followed by partial aerobic action in final stages.

Biodegradable — A substance that can be broken drown by micro-organisms.

Blast Gate — A sliding metal damper provided in a duct to regulate flow of forced air.

Blower — A fan used to force air or gas under pressure.

Boom — A heavy beam hinged at one end having a weight lifting device at the other.

Booster Cycle — The period during which additional hydraulic pressure is exerted to push the last charge of solid waste into a transfer trailer or container attached to stationary compactor.

Breeching — The passage through which products of combustion pass to a stack or chimney.

Breeching Bypass — An arrangement whereby breechings and dampers permit the intermittent use of two or more passages to direct or divert the flow of combustion products..

Briquetter — A machine that compresses the material into small pellets.

Bucket — An open container affixed to the movable arms of a wheeled or tracked vehicle to spread and/or excavate material.

Bullclam — A tracked vehicle equipped with a blade having a hinged curved bowl on its front top.

Bulldozer — A tracked vehicle equipped with an earth blade.

Burner, Conical — A hollow cone shaped combustion chamber having an exhaust vent at its top and a charging door at the bottom. It is also called a teepee burner.

Burner, Primary — A burner that dries and ignites material in the primary combustion chamber.

Burner, Refuse — A device for central or on-site burning of refuse. It is very simple in construction and all the factors of combustion are not controlled.

Burner, Residential — A device used to burn refuse generated in individual dwellings.

Burner, Secondary — A burner installed in the secondary combustion chamber to maintain a specified minimum temperature and complete combustion of incompletely burnt gases.

Burning Area — Horizontal projection of a grate, hearth or both.

Burning Rate — The quantity of solid waste incinerated (expressed as kg/m² h) or the amount of heat released (expressed as cal/m² h) during incineration.

C

Calorific Value — Number of heat units obtained by complete combustion of unit mass of a fuel.

Calorific Value (Lower) — *See* Heat Value (Low)

Calorific Value (Higher) — *See* Heat Value (High)

Capacity (of Incinerator)

a) *Design* — Quantity (expressed as tonnes/24 h) that it will be able to process, if specified criteria are met.

b) *Firm* — The processing capacity when its largest independent unit is not operating.

c) *Rated* — Quantity (expressed as tonnes/24 h) that is possible to process, when specified criteria prevail.

Capillary Water — Underground water that is held above ground water table by capillary action.

Carbon Dioxide — A colourless, odourless, nonpoisonous gas produced during thermal degradation and microbial decomposition of solid wastes.

Carbon Dioxide Recorder — An instrument that continuously monitors (in percent by volume) carbondioxide in flue gases.

Carbon Monoxide — A colourless poisonous gas having a faint metallic taste and odour. It is produced during thermal degradation and microbial decomposition of solid wastes when the oxygen supply is limited.

Carbon-Nitrogen Ratio — The ratio of mass of carbon to that of nitrogen present in compost or material being composted.

Carbonaceous Matter — Pure carbon or carbon compounds present in the fuel or residue after combustion.

Catalytic Combustion System — A process in which a substance is introduced into an exhaust gas stream to burn or oxidize vaporized hydrocarbons or odorous contaminants and the substance itself remains intact.

Cell — Compacted solid waste enclosed in natural soil or cover material in a sanitary landfill.

Cell Height — The vertical distance between top and bottom of the cell.

Cell Thickness — The perpendicular distance between the cover materials placed over last working faces of two successive cells in a sanitary landfill.

Charge — Quantity of solid waste fed into an incinerator at a time.

Charging Chute — An overhead passage through which waste material is fed into an incinerator.

Charging Cut-off Gate — A modified charging gate provided in a continuous fed furnace which does not have high temperatures near the charging hopper.

Charging Gate — A horizontal movable cover that closes the opening on a top charging furnace.

Charging Hopper — An enlarged opening at the top of a charging chute.

Checker Work — A pattern of multiple openings in a refractory wall through which products of combustion pass and accelerated turbulent mixing of gases occurs.

Chimney — A vertical passage through which products of combustion are let into atmosphere.

Chipper — A device having sharp blades attached to a rotating shaft which chips off pieces from objects.

Clamshell Bucket — A vessel having two jaws that clamp together when it is lifted by attached cables. It is used to hoist and convey materials.

Clinker — Hard, sintered or fused pieces of residue formed in a fire by agglomeration of ash, metals, glass and ceramics.

Collection — Removal of solid wastes from different collection points of a primary source.

Collection Frequency — The number of times collection is made in a given period of time.

Collection Method :

a) *Daily Route* — A method in which collection crew is assigned a weekly route that is divided into daily routes.

b) *Definite Working Day* — A definite route is allotted to different crew. The crew starts work and proceeds along the route till the end of working day. Next day collection starts from the point where it stopped the previous day. This goes on till the whole route is covered. Then the process is repeated.

c) *Group Task* — In this method, more than one crew is assigned to a few routes and they complete the job together.

Combustion Air, Theoretical — The amount of air required to completely burn the waste. The amount is calculated from the chemical composition

d) *Large Route* — In this method, each crew is assigned a large route which it completes in one week.

e) *Reservoir Route* — A method in which several crews are used to pick up on a centrally located route after having collected on peripheral routes.

f) *Single Load* — A variation of the daily route method in which areas or routes are laid out that normally provide a full load of solid waste.

g) *Swing Crew* — In this method, one or more reserve work crews are provided which go wherever help is needed.

h) *Variable Size Crew* — In this method, depending upon the amount and condition of work on particular routes, variable number of collectors are provided.

Collection Stop — A stop made by a vehicle and crew to collect solid waste from one or more service sites.

Collector (of Incinerator)

a) *Bag Type* — A filter having a fabric cylindrical bag as filtering medium.

b) *Cyclone* — A collector in which inlet gas stream moves vertically when the centrifugal force drives the suspended particles to its wall.

c) *Dust* — A device used to remove dust from exhaust gases.

d) *Flyash* — A device to remove flyash from combustion gases.

e) *Mechanical* — A device in which inertial and gravitational forces separate dry dust from gas.

f) *Multicyclone* — In this device a number of cyclone collectors are provided in parallel. The volume and velocity of combustion gas is regulated by dampers over a given load range.

Combustion — Chemical combining of oxygen with a substance which results in the production of heat and usually light.

Combustion Air — Air used for burning a fuel.

Combustion Air, Excess — Air that is supplied in excess of theoretical air. It is normally expressed as a percentage of theoretical air.

Combustion Air, Primary — Air that is added to combustion system at the point where fuel is first oxidized.

Combustion Air, Secondary — Air introduced above or beyond a fuel bed by natural, induced or forced draft. It is generally referred to as overfire air, if supplied above the fuel bed through the side walls or the bridge wall of primary chamber.

d) *Roll on/Roll off* — A large container (15-30 m^3) that can be mechanically pulled onto a service vehicle and transported to disposal site for emptying.

Container Train — A number of trailers connected in series and pulled by a motor vehicle. The system is utilized to collect and transport solid wastes.

Contract — A written agreement in which rights and duties of contractual parties are clearly set forth for collection of solid wastes.

Conversion — Action of changing the condition of a secondary material.

Conveyor

a) *Apron* — It has one or more continuous chains that are supported and moved by a system of sprockets and rollers which carry overlapping or interlocking plates that move bulky materials on their upper surface.

b) *Drag* — A conveyor that uses vertical steel plates fastened between two continuous chains to drag material across a smooth surface.

Cooling Air — Ambient air that is added to hot combustion gases to cool them.

Cooling Spray — Water spray directed into flue gas stream to cool it and remove flyash.

Corrosion — The alteration of a material by chemical action.

Cover Material — Material (normally soil) used to cover compacted solid waste in a sanitary landfill.

Crane

a) *Bridge* — A lifting unit that can manouvre horizontally in two directions.

b) *Monorail* — A lifting unit suspended from a single rail which can move in one horizontal direction.

Cullet — Clean colour sorted crushed glass used in glass-making to hasten melting of silica sand.

Cut — Portion of a land surface or an area from which earth or rock has been or will be excavated.

Cut and Cover — Trench method of landfilling.

Cut-off Trench — A trench that is filled with material that is impermeable to the flow of gas and water to prevent movement or intercept and direct them to another location.

Disposal

a) *Ocean* — The disposition of a waste into an ocean or estuarine body of water.

b) *On-site* — The use of methods or processes to eliminate or reduce the volume or mass of solid waste at the point of generation.

c) *Waste* — An orderly process of discarding useless or unwanted material.

Downpass — A chamber or gas passage placed between two combustion chambers to carry the combustion products downwards.

Draft — Difference between the pressure in an incinerator or any component part and that of the atmosphere.

Draft, Forced — Draft caused by positive pressure exerted by the action of a fan or blower.

Draft, Induced — Negative pressure caused by the action of a fan, blower or ejector.

Draft, Natural — The negative pressure created by the height of a stack or chimney and the difference in temperature between flue gases and atmosphere.

Draft Controller — An automatic device which by regulating a damper maintains a uniform furnace draft.

Dragline — A revolving shovel that carries a bucket by cables and digs by pulling the bucket towards it.

Drag Plate — Plate below a travelling stoker used to support the returning grates.

Drum Mill — A long inclined steel drum which rotates and grinds solid wastes in its rough interior. The drum has its end portion in the form of a sieve.

Dulongs Formula — A formula for calculating approximate heat value of solid fuel based on its ultimate analysis.

Dump — A land site where disposal of solid waste occurs without proper measures for environmental protection.

Dumping — An indiscriminate method of disposing of solid waste.

Dump Plate — A hinged plate in an incinerator which supports residue. The plate can be rotated to discha.ge the residue.

Dust — Solid particles predominantly larger than colloidal ones and capable of temporary suspension in air or other gases. They do not tend to flocculate except under electrostatic forces; they also do not diffuse but settle

under the influence of gravity. Derivation from larger masses through the application of physical force is usually implied.

Dust Loading — The amount of dust in a given amount of gas. Usually applied to the contents of collection ducts and the emissions from stacks.

E

Earth Blade — A heavy plate connected at the front of a tractor to push and/or spread soil or other material.

Ecology — Science that deals with the interrelationship of organisms and their living and nonliving surroundings.

Ecosystem — The interdependence of organisms and their surroundings.

Effluent

a) A liquid which flows out of a containing place.

b) Sewage, water or other liquid, partially or completely treated, or in its natural state, as the case may be, flowing out of a reservoir, basin, or treatment plant or part thereof.

Electrostatic Precipitator — A device for collecting particulates by placing an electric charge on them and then attracting them to a collecting electrode.

Elutriation — Separation of solid waste into heavy and light fractions by washing.

Emissions — The sum of total substances discharged into air from a stack, vent or any other discrete source. It is generally applicable to harmful and injurious substances.

Emission Standard — A rule or measurement established to regulate or control the amount of a given pollutant which may be discharged into the atmosphere from the source.

Engine Sidescreen — A rugged screen fitted on the engine housing of a vehicle used at sanitary landfill to keep paper and other objects from accumulating and damaging the engine.

Environment — The conditions, circumstances and influences surrounding and affecting the development of an organism or group of organisms.

Environmental System — The interaction of an organism or group of organisms with its natural and man-made surrounding.

Erosion

a) *Accelerated* — Erosion occurring at a rate faster than the natural rate.

b) *Refractory* — The wearing away of refractory surface by the action of moving liquids or gases.

Evase Stack — An expanding connection provided on the outlet of a fan or in an airflow passage which converts kinetic energy into static pressures.

Expansion, Permanent — It is the ability of some refractories to increase in size permanently at temperature within their useful range. It is also known as secondary expansion.

Expansion Joint, Refractory — An open joint which allows the refractories to expand thermally or permanently.

F

Facultative — Able to live and grow with or without free oxygen.

Fan, Induced Draft — A fan for exhausting hot gases from heat absorbing equipment, dust collectors or scrubbers.

Fan, Overfire Air — A fan used to provide air above a fuel bed.

Field Capacity — The amount of water retained in solid waste, which after saturation is allowed to drain freely. It is also known as moisture holding capacity.

Filter Bag — A device having one or more fabric bags for recovering particles from dust laden gas or air.

Filter Fabric — A device to remove particles from a carrier gas by passing it through a porous (fabric) medium.

Firebrick — Refractory brick made from fireclay.

Fireclay — A sedimentary clay containing only small amounts of fluxing impurities which is capable of withstanding high temperature.

Fixed Carbon — Ash-free carbonaceous material that remains after the volatile matter is driven off during proximate analysis of the solid waste sample.

Flareback — A burst of flame from a furnace in a direction opposite to the normal gas flow.

Flue — A passage designed to carry combustion gases and entrained particles.

Flue Dust — Solid particles smaller than 100 microns carried in the products of combustion.

Flue Gas — Waste gas from a combustion process.

Fluidized Bed Technique — A combustion process in which heat is transferred from finely divided particles such as sand to combustible materials when kept in a fluidized state in a combustion chamber.

Fly Ash — The finely divided particles of ash entrained in flue gases arising from the combustion of fuel. The particles of ash may contain incompletely burned fuel. The term has been applied predominantly to gas-borne ash from boilers with spreader stoker, underfeed stoker, and pulverized fuel (coal) firing. The particles fall to the ground close to the point of release.

Food Processing Waste — Wastes resulting from operations that alter the form or composition of agricultural products for marketing purposes.

Food Waste — Animal and vegetable waste resulting from the handling, storage, sale, preparation, cooking and serving of foods; commonly called garbage.

Front End Loader — A collection vehicle with arms that engage a detachable container, move it over the cab and empty it in a container and return it to the ground.

Fuel Bed — Layer of solid fuel or waste on a furnace grate or hearth.

Fume — Gas containing particles less than one micron in diameter in suspension.

Fungi — Multicellular nonphotosynthetic plants.

Furnace — Chambers of an incinerator where drying, ignition and combustion occur.

Furnace Volume — The total internal volume of a combustion chamber.

Fusion Point — Temperature at which a particular complex mixture of minerals can flow under the weight of its own mass.

G

Garbage — Waste food material originally intended for or associated with food for human consumption.

Garbage Grinder, Central — A conveniently located facility that mechanically pulverizes food waste collected from various sources in a community.

Garchey System — A patented system in which refuse is first stored in a water filled flushing device under a sink from where it is conveyed through tubes to a central holding tank.

Gasification — The process of converting a solid or liquid fuel into a gaseous fuel.

Generation — Act or process of producing solid wastes.

Grader — A pneumatic wheeled vehicle having a centrally located blade which can be angled to cast to either side.

Gradient — Degree of slope.

Grapples — A clamshell type bucket having 3 or more jaws. It is also called a star or orange peel bucket.

Grate — A device which supports solid fuel or solid waste during drying, ignition and combustion and the openings in it permit air to pass through it.

Grate, Fixed — A grate without any moving parts.

Grate, Movable — A grate with moving parts.

Grinding — Mechanical pulverization of solid wastes.

Ground Water — Water in the ground beneath the surface. In a strict sense the term applies only to water below the water table but in the general sense it covers water derived from wells and springs.

Ground Water, Free — Ground water in aquifers that are not bound or confined in impervious strata.

Ground Water, Run-off — It is that portion of ground water which is discharged into a stream as spring or seepage water.

Grouser — A cleat extending across the track of a crawler tractor to improve its traction.

Grout — A cementing mixture containing cement, water, sand, sawdust and other fillers.

H

Hammermill — A category of high speed equipment which have pivoted or fixed hammers to crush or shred solid waste.

Haul Distance

a) The distance between last collection point of a refuse vehicle and transfer station or processing or disposal facility.

b) The distance between a transfer station or processing facility and disposal site.

c) The distance through which cover material has to be transported from excavation or stockpile to the working face of a sanitary landfill.

Haul Time — The time spent in transporting solid waste between two specific locations.

Hearth

a) *Burning*— A solid surface, without any air openings, to support the solid fuel or soil waste in a furnace during drying, ignition or combustion.

b) *Cold Drying* — A surface upon which unheated waste material is placed for drying or burning. The process is aided by hot combustion gases passing over it.

c) *Drying* — A solid surface in an incinerator where the wet waste material is kept before burning to dry or burn with the aid of hot combustion gases.

d) *Hot Drying* — A surface upon which waste material is kept to dry or burn. The hot combustion gases first pass over and then under the hearth.

Heat Available — The amount of useful heat produced per unit of fuel completely burnt minus the heat values of dry fuel gases and water vapour.

Heat Balance — An account carried out on hourly basis of the heat input and output of an incinerator.

Heat Exchanger — An equipment which transfers heat from one fluid to another without allowing them to mix.

Heat of Combustion — The heat released when a unit quantity of waste or fuel is burned.

Heat Release Rate — The amount of heat released during complete combustion. Generally it is expressed as kcal/m^3 (of internal volume of furnace) h.

Heat Value, High — The amount of heat, expressed in kilocalories liberated when a kilogram of solid waste is completely burnt and the products of combustion are cooled to initial temperature of solid waste as in a calorimeter.

Heat Value, Low — The high heat value minus the latent heat of vaporization of water formed by burning the hydrogen in fuel.

Heavy Media Separation — Separation of solid wastes into heavy and light fractions with the aid of a fluid medium having density between the two.

Hog Feeding — Utilization of heat treated food waste as livestock feed.

Humus — Stabilized organic matter.

Hydraulic Scooper — A self-propelled crawler vehicle having hydraulically operated arms which lift, empty and replace containers carried on a transfer trailer bed.

Hydraulic Tipper — A device which unloads a transfer trailer by raising its front end to a 70° angle.

Hydrology — Science dealing with the occurrence, properties, distribution and flow of water in nature.

Ignition Temperature — Lowest temperature at which a fuel can be burnt by a self-sustaining combustion reaction.

Impact Mill — A machine which grinds material by throwing it against heavy metal projections rigidly attached to a rapidly rotating shaft.

Incineration — It is a controlled combustion process in which the waste is burnt and converted into gases and a residue containing little or no combustible material.

Incinerator — An engineered apparatus used to burn waste substances and in which all factors of combustion, such as, temperature, retention time, turbulence and combustion air can be controlled.

Incinerator, Batch Fed — An incinerator in which one charge is fed and only after it is completely burnt, the next charge is added.

Incinerator, Cell Type — An incinerator whose grate areas are divided into cells, each of which has its own ash pit and air supply.

Incinerator, Central — A facility located at a convenient point which burns waste collected from different sources.

Incinerator, Chute Fed — An incinerator that is charged through a chute which extends two or more floors above it.

Incinerator, Continuous Fed — An incinerator into which solid waste is fed more or less continuously to maintain a steady rate of burning.

Incinerator, Controlled Air — An incinerator having more than one combustion zone in each of which distribution of air is controlled.

Incinerator, Direct Fed — An incinerator in which solid waste is fed directly in the combustion chamber.

Incinerator, Flue Fed — An incinerator that is charged through a shaft which functions as a chute for charging waste and has a flue to carry the products of combustion.

Incinerator, Industrial — An incinerator designed to burn industrial wastes.

Incinerator, Multiple Chamber — An incinerator consisting of two or more chambers arranged as in line (known as in-line type) or retort types (known as retort type), interconnected by gas passage ports or ducts.

Incinerator, Municipal — An incinerator primarily designed to burn municipal (residential and commercial) solid wastes.

Incinerator, On-site — An incinerator which burns the waste on the same premises which generates it.

Incinerator, Open Pit — A burning device that has an open top and a system of closely spaced nozzles that place a stream of high velocity air over the burning zone.

Incinerator Gas — *See* Flue Gas.

Inclined Plate Conveyor — A separating device in which material is fed onto an inclined steel plate belt conveyor. Heavy and resilient materials like glass bounce down the conveyor while light and inelastic materials are carried forward by motion of the belt.

Indore Process — It is an aerobic composting method in which refuse and human excreta are put in alternate layers in a pit. The material is turned twice to ensure composting remains aerobic.

Inoculum — Micro-organisms placed in a culture medium, soil, compost, etc.

J

Junk — Unprocessed material suitable for reuse or recycling.

K

k-Factor — The thermal conductivity of a material expressed as kcal/m h deg.

Kerb Collection — Collection of solid waste from containers placed adjacent to a thoroughfare.

L

Land Disposal — Deposition of waste on or into trenches or uneven land surface.

Landfill Blade — A U-blade having an extension at the top so that a larger volume of solid waste can be pushed and spread and protects the operator from any debris.

Lantz Process — Destructive distillation of solid waste in which combustible components are converted into gas, charcoal and a number of distillates.

Leachate — Liquid that has travelled through solid waste or other medium and has extracted dissolved or suspended material from it.

Lift — A compacted refuse layer and the top cover material in sanitary landfill.

Lining — The refractory material used on the inside of a furnace wall.

Litter — Carelessly discarded material.

Load Bearing Capacity

a) *Safe* — Ratio of ultimate bearing capacity divided by a factor of safety.

b) *Ultimate* — It is the load intensity transmitted by base of footing of foundation to soil and causes the soilmass to rupture or fail in shear.

Lysimeter — A device used to measure rate of movement of water through or from a soil layer or used to collect percolated water for quality analysis.

M

Manure — Excreta of animals which may contain some spilled feed or bedding.

Material Balance — An account on hourly basis of material entering and leaving a processing unit such as an incinerator.

Membrane Barrier — A thin layer of material impermeable to flow of gas or water.

Metals — In the secondary materials industry, metals include all ferrous, nonferrous and alloy materials.

Methane — A colourless, odourless, asphyxiating gas that can explode under certain conditions, and can be produced by anaerobic decomposition of solid wastes.

Milled Refuse — Solid waste which has been mechanically reduced in size.

Mixing Chamber — A chamber normally placed between primary and secondary combustion chambers where products of combustion are thoroughly mixed by turbulence created by increased velocity of gas, change of flow direction etc.

Moisture Content — Percentage ratio of loss in mass to the original mass when the sample is dried to a constant mass at a temperature of 100-105°C.

Moisture Penetration — The depth to which water penetrates the solid before its rate of flow becomes negligible.

Municipal Collection — Collection of solid wastes by municipal employees and equipment carried out under the supervision and direction of a municipal department or official.

O

Odour Threshold — The lowest concentration of a substance in air at which its odour is perceptible.

Offal — Intestines and discarded parts including paunch manure of slaughtered animals.

Open Burning — Uncontrolled burning in open.

Open Dump — *See* dump

Organic Content — It is synonymous with volatile solids except for some small traces of some inorganic materials such as calcium carbonate which lose mass at temperatures used in determining volatile solids.

Organism — Any living thing.

Orsat Apparatus — An apparatus used to volumetrically analyse flue gases by measuring amounts of carbon dioxide, oxygen and carbon monoxide present.

P

Pathogen — An organism capable of producing disease.

Peephole Door — A small door or a hole in an incinerator through which combustion can be observed.

Percolation — Downward movement of water through soil, solid waste or other porous medium.

Permeability — The capacity of a porous medium to conduct or transmit fluids.

***p*H** — Logarithm to the base 10 of reciprocal of hydrogen ion concentration.

Picking Table (or Belt) — Table or belt on which solid waste is manually sorted and some constituents removed.

Pollution — Presence in the environment of some substances of such type and quantity that the quality of the environment is impaired or rendered offensive to life.

Polyvinyl Chloride — A common plastics material which releases hydrochloric acid when burned.

Private Collection — The collection of solid waste by individuals or companies from residential, commercial or industrial premises; the arrangements for the service are made directly between the owner or occupier of the premises and the collector.

Processing — A method or process to change the physical form or chemical content of solid wastes.

Products of Combustion — Gases, vapours and solids resulting from the combustion of a fuel.

Pulverization — Crushing of material into small pieces.

Putrefaction — Microbial decomposition of organic matter accompanied by odours.

Pyrolysis — Destructive distillation of a material in the absence of oxygen.

Pyrometer — An instrument for measuring temperature.

Pyrometer, Optical — A pyrometer based on optical principles.

Pyrometer, Radiation — A pyrometer which measures temperature of a material from the intensity of radiation at all wavelengths emitted by it.

Q

Quench Trough — A water filled trough to receive burning residue from an incinerator.

R

Rasper (Rasp Mill) — A size reduction unit having a large vertical drum with heavy hinged arms rotating horizontally over a rasp and sieve floor.

Rated Load (of Crane) — The maximum load that a crane can handle.

Reclamation — Restoration to a better or more useful state or the obtaining of useful materials from solid wastes.

Recovery — The process of obtaining materials or energy resources from solid wastes.

Recycling — The process by which waste materials are transformed into new products in such a manner that the original products lose their identity.

Refuse — It includes all kinds of wastes in solid state, excepting excreta, coming from residential, commercial and industrial areas.

Refuse Chute — A pipe, duct or trough through which solid waste is conveyed to a central storage area.

Refuse Train — *See* container train.

Residue — Material remaining after gases, liquids or solids have been removed.

Residue Conveyor — A conveyor, usually a drag or flight type used to remove incinerator residue from a quench trough to a discharge point.

Residue, Incinerator — All solid material collected after incineration process is completed.

Reuse — The reintroduction of a commodity into the economic stream without any change.

Ringelmann Chart — Printed or photographically reproduced illustration of 4 shades of grey used to estimate density of smoke from a source.

S

Salvage — Utilization of waste material.

Salvaging — Controlled removal of waste material for utilization.

Sanitary Landfill — A site where solid waste is disposed of by using method of sanitary landfilling.

Sanitary Landfilling — An engineering method of disposing of solid wastes by spreading it in layers, compacting it to the smallest practical volume and covering it by a soil layer at the end of the day or more frequently.

Sanitary Landfilling Method

a) *Area* — A method which utilizes uneven surface of ground. The waste is spread on the undulating surface, compacted and then covered by soil layer.

b) *Quarry* — A variation of area method in which the wastes are spread and compacted in a depression. Cover material is brought from elsewhere.

c) *Ramp* — Another variation of area method where the cover material is obtained by excavating in front of working face.

d) *Trench* — A trench is excavated and the space filled by refuse which is compacted. The excavated soil is used as cover material.

e) *Wet Area* — Method used in swampy area where first inert layer is given till it rises above normal water level and then normal area method is used.

Sanitation — Control of all such factors which affect the physical environment which can affect human health, survival and development.

Satellite vehicle — A small vehicle which discharges its contents into an accompanying large vehicle.

Scavenger — A person involved in uncontrolled removal of material at any point in a solid waste stream.

Scrap — Discarded or rejected materials or parts resulting during fabrication and manufacture, which can be reprocessed.

Scrap, Home — Scrap that is reprocessed in the place where it is produced.

Scrap, Obsolete — Scrap that results when the material gets worn out and cannot be used for its original purposes.

Scrap, Prompt Industrial — Scrap left over from the fabrication of iron and steel products.

Screen

a) *Rotary* — An inclined cylindrical mesh rotating on its axis which screens material placed at its upper end.

b) *Vibrating* — Inclined screen which is mechanically vibrated to screen material placed over it.

Screw Conveyor — A rotating helical shaft that moves material along a trough or tube.

Scrubber, Flue Gas — Equipment to remove fly ash and other objectionable material from flue gas by use of sprays, wet baffles etc.

Secator — A separating device which throws mixed material onto a rotating shaft. Heavy and resilient materials bounce off one side of the shaft while light and inelastic materials land on the other and are cast in the opposite direction.

Secondary Material — A material that is used in place of primary or raw material in the manufacture of a product.

Separator

a) *Ballistic* — A device in which mixed materials having different physical characteristics are dropped on a high speed rotary impeller when they are hurled at different velocities and fall in separate collection bins.

b) *Inertial* — A device that relies on gravity separation of materials having different physical characteristics.

c) *Magnetic* — A device which removes ferrous metals by a magnet.

Settlement — A gradual subsidence of materials.

Settlement, Differential — Non-uniform subsidence of material from a fixed horizontal reference plane.

Settling Chamber — A chamber to reduce velocity of fluid to help separate out suspended solids.

Sewage Sludge — A semiliquid containing settled sewage solids and varying amounts of water and dissolved material.

Shear Shredder — A size reduction unit which cuts material between two large blades or between a blade and a stationary edge.

Shredder — A device to reduce discarded automobiles and other low grade sheet and coated metal in a continuous operation to small pieces.

Siftings — The fine material which falls from fire bed through grate openings in incineration.

Sintering — A heat treatment that causes adjacent particles of a material to cohere below a temperature that would cause them to melt.

Slag — A substance formed by chemical action and fusion at furnace operating temperatures.

Slagging of Refractories — Destructive chemical action which forms slag on refractories subjected to high temperatures. It also refers to molten or viscous coating produced on refractories by ash particles.

Sloughing — Disattachment of slime and solids accumulated on a contact surface as in tricking filters.

Sludge — A semiliquid sediment.

Smoke — A suspension in air or gas of particulates produced by incomplete combustion of carbonaceous material.

Smoke Alarm — An alarm given by an instrument which continuously measures density of smoke on the basis of obscuring of a beam of light and gives an alarm when the smoke density exceeds a preset value.

Smoke Eye — A device consisting of a light source and a photoelectric cell that measures the degree to which smoke in a flue gas obscures light.

Solid Waste — *See* Refuse.

Solid Waste, Agriculture — Solid waste resulting from processing of field crops and orchards and from rearing and slaughtering of animals.

Solid Waste, Commercial — Solid waste generated by shops, offices and other commercial activities which do not actually turn out a product.

Solid Waste, Industrial — Solid waste resulting from industrial and manufacturing processes.

Solid Waste, Institutional — Solid wastes originating from educational, health care and research facilities.

Solid Waste, Municipal — It includes commercial and residential wastes generated from a community.

Solid Waste, Pesticide — Residue resulting from manufacturing, handling or use of chemicals for killing animal and plant pests.

Solid Waste, Residential — Solid waste generated from residential environment. It is also called domestic solid waste.

Solid Waste, Management — A purposeful systematic control of the generation, storage, collection, transport, processing and disposal of solid waste.

Spalling of Refractories — Breaking or crushing of a refractory unit due to thermal, mechanical or structural causes.

Spray Chamber — A chamber equipped with water sprays to cool products of combustion passing through it.

Stack — *See* Chimney.

Stack Effect — Vertical movement of hot gases in a stack occurring due to its being lighter than atmosphere.

Stack Sampling — Collection of representative sample of gases and particulate matter flowing through a stack.

Stoker — A mechanical device to feed solid fuel or solid waste to furnace.

Stoker, Chain Grate — A stoker having a moving chain as a grate surface. The grate consists of links mounted on rods to form a continuous surface which is generally driven by a shaft with sprockets.

Stoker, Incinerator — A mechanically operable moving grate arrangement for supporting, burning, and transporting solid waste in a furnace and discharging the residue.

Stoker, Inertial Grate — A stoker consisting of a fixed bed of plates carried on rollers and activated by an electrically driven mechanism. It draws the bed slowly back against a spring and then releases it so that the entire spring bed moves forward until stopped abruptly by another spring. The inertia of solid waste carries it a small distance forward along the stoker surface and then the cycle is repeated.

Stoker, Oscillating Grate — A stoker in which the entire grate surface oscillates to move the solid waste and residue over grate surface.

Stoker, Reciprocating Grate — A stoker consisting of a bed of bars or plates so arranged that alternate pieces or rows of pieces slowly reciprocate in a horizontal sliding mode and act to push the solid waste along the stoker surface.

Stoker, Rocking Grate — A stoker consisting of a bed of bars or plates on axles which are rocked in a coordinated manner to lift and advance the solid waste along the grate surface.

Stoker, Rotary Kiln — An inclined rotating cylindrical unit in which solid waste cascades and moves forward.

Stoker, Travelling Grate — A stoker in the form of a moving chain belt carried on sprockets and covered with separated small metal pieces called keys. The entire top surface acts as grate which moves to the bottom side at end of furnace and again enters the furnace at other end.

Storage Pit — A pit for storing solid waste before processing.

Street Refuse — Refuse collected from streets when they are cleaned either manually or mechanically.

T

Tailings — Second grade or waste material obtained when raw material is screened or processed.

Teepee Burner — *See* Burner, Conical.

Tempering Air — *See* Air, Cooling.

Thermocouple — Device to measure temperature in which two lengths of wires made from different kind of homogeneous metals are used.

Tipping Floor — Unloading area for vehicles which deliver solid waste to a processing plant.

Toe — Bottom of working face of a sanitary landfill.

Topsoil — Topmost soil layer which is normally expected to contain humus and support plant growth.

Transfer Station — A site at which solid waste is transferred from one set of vehicles to another directly or after compaction.

Transport — Movement of solid wastes subsequent to collection.

Trash — *See* rubbish.

Trommel Screen — *See* screen rotary.

U

U-Blade — A dozer blade having projections on either side at an obtuse angle so that larger volume of waste can be handled.

Unloading Bulkhead — A steel plate to eject waste out of the rear door of an enclosed transfer trailer.

V

Vector, Disease — A carrier capable of transmitting a pathogan from one vector to another.

Volatile Matter — Material lost from a dry solid waste sample which is heated till red in a closed crucible.

Volatile Solids — Material lost from a dry solid waste sample which is heated till red in an open crucible in a ventilated furnace.

W

Wall, Air Cooled — A refractory wall having a lane directly behind it through which cool air passes.

Wall, Core — The central course of the common wall between the two combustion chambers which is not exposed on either side.

Wall, Curtain — A refractory construction or baffle which deflects combustion gases downwards.

Wall, Water Cooled — A furnace wall composed of boiler tubes.

Waste — *See* also solid waste.

Waste, Bulky — Very large sized waste, the handling of which poses problem in normal collection, processing or disposal methods.

Waste, Construction or Demolition — Building material or rubble resulting from construction, remodelling, repair and demolition operations.

Waste, Hazardous — Wastes that need special handling to avoid illness or injury to persons or damage to property.

Wastes, Special — Needing extraordinary management.

Waste Processing — Operations which change the physical or chemical properties of wastes.

Waste, Sources of — Various activities which generate wastes.

Wet Milling — Mechanical size reduction of solid waste which has been wetted to soften the paper and paper product constituents.

Wet Pulping — *See* wet milling.

Working Face — That portion of sanitary landfill where collection vehicles discharge material prior to placement of cover material.

Y

Yard Tractor — Small tractor used exclusively for manouvring trailers into and out of loading position.

Z

Zone of Aeration — Zone above water table the pores of which are not completely filled with water.

Zone of Capillarity — Zone above water table where some or all of the pores are filled with water that is held by capillarity.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg. m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2