

SOLID WASTE MANAGEMENT: NEED, INNOVATIONS AND STRATEGIES

[A case Study of Bhopal Municipal Corporation (BMC)]

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Introduction:

Solid Waste Management is perhaps the most essential house-keeping service required by urban dwellers to maintain their quality of life. In India, this service lags behind, leading to some chaos in the urban sector. Institutional weaknesses, shortages of human and financial resources, improper technology, inadequate coverage, improper collection, transportation, disposal and lack of overall proper planning are associated with the weakness of solid waste management system in most of the cities of India. This has significant implications for the health of residents, municipal staff, industrial workers and overall urban investment climate.

Bhopal is only a small exception. City dwellers are facing the hazards of improper and inadequate solid waste management. This has crippled not only the general health and hygiene management of the city, but has also adversely influenced the poverty alleviation programmes. The city requires substantial improvement in the SWM practices prevailing to raise the over-all quality of life in view of the irreversible urbanization. To maximize efficiency and effectiveness of municipal management system, it is necessary to tackle the problem systematically by appreciating in a city specific manner the different dimensions of SWM and devise cost effective systems which would be viable in the available socio-economic and politico-environmental setting.

Bhopal Municipal Corporation has now given a serious look to these problems and has also begun mobilizing community and technical expertise from relevant support organizations.

The City of Bhopal the "Hiroshima" of India?

Bhopal, the capital city of Madhya Pradesh, a Province in Central India, is known for its rich natural endowments and the diversity of its natural, physical and cultural resources. It is located in a hilly undulating region (550-600 meter MSL). The hinterland of Bhopal slopes north and southeast. The hillocks and lakes in the city create favourable conditions for environmental conservation and city management practices because of its gradient. Two main streams i.e. Betwa and Narmada, the former flowing towards north and the later flowing towards west, provide the drainage to the city. Halali nallahs from the northwest and Kaliasot from southeast meet Betwa and Kolar from the southwest joins river Narmada.

Bhopal is also the "*Hiroshima*" of India. In 1984 the Union Carbide Chemicals factory mismanagement caused leakage of poisonous gas MIC (Methyl Isocyanate) leading to the death of over 5000 persons and the permanent impairment of almost a hundred thousand others. After a protracted legal battle some succor has been provided to those affected. This has left a permanent psychological scar over the city of Bhopal.

Bhopal has a subtropical moderate climate where the temperature ranges between 07 deg CIs (January) to 45 deg CIs (May). The average annual rainfall is between 125 – 150 cm most of them being experienced during July-September. Two lakes (upper and lower) give distinct character to the city. Besides providing scenic and aesthetic beauty these are perceived the lungs of the city. It not only fulfils the habitat obligation of drinking water but also lends fun and pleasure (water sports) for the city dwellers. However, the growing population and increasing refuse in all its states (solid,liquid and gas) has started affecting adversely the ecological and environmental aspects of the city. The improper SWM practices would further deteriorate the life sustaining aspects of lakes in the city and the Lake.

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The Municipal Corporation of Bhopal is spread over an area of 285.88 square Kms which can be classified as follows:

OLD CITY	41.58 Sq. Kms	BHEL	44.18 Sq. Kms
NEW CITY	77.97 Sq. Kms	VILLAGE AREA	122.15 Sq. Kms

Out of the total municipal area only 77.25 Sq. Kms is classified as the developed area. The rest consist of open spaces, water bodies and other unplanned peripheral areas some of which are being used as a dumping ground for the solid waste.

MUNICIPAL DEMOGRAPHY:

Till 1950, Bhopal experienced a gradual increase in population. But with the establishment of BHEL Plant and declaration of Bhopal as a capital city its population swelled from 1.0 Lakh in 1951 to 2.22 Lakhs in 1961 (118% Growth Rate). During the two decades of 1961-81 the population of Bhopal tripled (6.71 Lakhs) and in 1991 it touched the million mark. According to 2001 census the population of Bhopal city is 14,33,875 (39% decadal growth rate)

YEAR	POPULATION OF BHO PAL	DECADAL GROWTH RATE
1951	1.02 Lakh	
1961	2.22 Lakh	118 %
1971	3.84 Lakh	72.6 %
1981	6.71 Lakh	74.4 %
1991	10.62 Lakh	58.5 %
2001	14.33 Lakh	35 %

Pull factor of Bhopal has been the major factor for unprecedented growth of population. Within the city 64% of the work force is engaged in tertiary activities, 32.8 % in secondary activities and 3.2 % in the primary activities. The work force distribution reflects the predominance of administrative functions as well as people's involvement in the informal sector.

The city does have some large industrial houses in and around its periphery. The main industries are: 1) BHEL. 2) Railway Coach Factory 3) Mandideep Industrial Growth Centre and 4) Govindpura Industrial Area. Besides there are very small scale industries like saw mills, oil mills, printing presses and dairies are relatively unorganized.

The city is divided into 66 Wards and 11 Zones. The elected body has a term of 5 years. The corporation performs its function as per the provisions of an Act governing the Municipal Corporations in the State. The administration of the corporation is under the Mayor. The Municipal Commissioner is the CEO, and is a senior State Administrative Service Officer. The Municipal Commissioner is assisted by a work force of municipal officers. For the purpose of SWM activities the Commissioner is assisted by 2-health officers, several supervisory staff's as given below assist these Health Officer.

Chief Sanitary Inspectors	-	4
Sanitary Inspectors	-	16
Sanitary Supervisors	-	60
Jamadaars	-	60

The SWM department of Bhopal Municipal Corporation has work force of 1900 persons for street sweeping, 300 for transportation and disposal of waste and 580 temporary labors for collection and transportation of waste.

PRESENT STATUS:

(A) PHYSICAL CHARACTERSTIC OF WASTE

S.No.	CHARACTERSTICS	CONTENT	%
1	PAPER		8.5
2	PLASTIC	0.5	3.5
3	METAL	0.4	1.5
4	Glass	0.3	1.0
5	Ash and fine earth	30	50
6	Total compostible matter	30	50
7	Moisture contents	20	30
8	Organic matter	20	45.5
9	Calorific value (Kcl/Kg)	800	35.5

(B) CHEMICAL CHARACTERSTIC OF CITY WASTE:

S.No.	Moisture	Ph value	Organic	Carbon	Nitrogen	Phosphorus P2)as%	Potash K2)as %	C/N Raito
1	26.94	7.9	32.76	21.72	0.70	0.65	0.98	28.57
2	29.50	7.6	34.36	20.86	0.67	0.72	0.76	27.52
3	21.36	7.2	32.34	10.37	0.72	0.60	0.54	27.48

(C) COMPOSITION OF WASTE

M.P.State Agro Development Corporation has set up a compost plant of 120 MT/Per day capacity on a plot of land adjoining the land fill site as shown below. The plant is run at 60% of installed capacity. The company pays lease rent of Rs.10,000 per year for 20,000 Sq Mt. of land given for the compost plant by the Corporation.

(D) DISPOSAL OF WASTE

The city has 75 acres for waste disposal. The waste generated in the city is deposited at this land fill site. The land fill site is situated in Bhanpur village at a distance of 16 kms from the city. No scientific method of waste disposal is adopted. All waste is disposed of at the landfill site adopting of crude dumping of waste.

(E) NUMBER AND TYPE OF VEHICLES UTILIZED FOR TRANSPORTATION

S.No.	Type of vehicle	No	Capacity (average) in Tones	Trips per day	Total collection per day in Tonnes
1	Trucks (Mini)	32	3.0	2	192
2	T.Trolley	18	2.0	2	32.00
3	Refuse compactors	11	6	2	132
4	Mini compactor	2	6	2	24.0
5	Dumper Placers each with 5 bins	9	2	2	90.0
				Total	450 tons/day

No transportation is done on Sundays and public holidays, Backlog is therefore created on the day following the holidays.

(F) COMMUNAL STORAGE OF WASTE

The city has 990 official Communal Waste Storage sites as under:

1) Kachara ghar (dustbin)	50
2) Metal Containers	350
3) RCC Rings	300
4) Open Sites	210
5) Containers	80

Total 990

The above shown sites (1) to (4) are not suitable for temporary storage of waste. The RCC bins overflow and open sites pose a problem of health and sanitation. The metal containers are well utilized.

(G) WORK NORMS:

The street sweepers on an average are given 10,000 Sqft. of sweeping area. Which, is reduced to 7500 Sqft. in the area where drains are also to be cleaned.

The working hours are from 6:30 AM to 10:30AM and 3:00PM to 6:00PM

ISSUE AND PROBLEMS:

- 1) Storage of waste at source is not fully taking place as people prefer to dispose the waste as and where it is generated.
- 2) Segregation of recyclable wastage is not yet adopted and often found mixed with garbage disposed at different places.
- 3) The system of door-to-door collection of waste is not yet adopted and street sweeping is the main method of waste collection.
- 4) For street sweeping the old city area is divided into beats (divisions) and 10,000 Sq. Feet area is allotted to one sweeper.
- 5) In the newly developed area 1,900 sweepers are engaged to clean the street of 541 Km of length. New Bhopal and BHEL area is generally cleaned by group of sweepers.
- 6) In 68 villages sweeping is done once in a week by a group of sweepers.
- 7) There are 88 colonies developed by BDA, Housing Board Colony and PWD where cleaning is not done by these sweepers.

- 8) The street sweeping is done by the team of 3 members, out of them one sweeps the street, other cleans open drains and the third one picks up the waste in the cart.
- 9) Transportation of the waste is done through various vehicles like trucks, trolleys, refuse compactors and dumpers etc. No transportation is done on public holidays and Sundays.
- 10) About 600 MT of SW is generated in the city per day. Which is collected through street sweeping and from the communal waste storage sites.
- 11) MP State Agro Development Corporation has setup a compost plant of 120 MT per day capacity on a plot adjoining the landfill site.
- 12) The city has 75 acre of land for waste disposal which is situated 16 Kms away from the city. The waste is disposed off at the landfill site in orthodox method of dumping.

The National Backdrop

(i)

50 years of waste generation		
	1947	1997
Urban population (millions)	56.9	247
Daily per capita waste generation (grams)	295	490
Total waste generated (million tones)	6	48
Area under land fills (thousand of ha)	0.12	20.2
Annual methane emission (tones) from land fills sites	0.87	7.1

Studies reveal that only about 7 to 15% of the waste is recycled. However, it is difficult to establish the quantum of waste recovery. There are various types of waste, which are recycled to produce different products. The process of recycling and its environmental implications are yet to be studied in detail. On one hand recycling helps in reducing the quantity of waste but, on the other it may invite some of the pollution problems. There is a need to develop waste recycling center (WRC). Such centers could develop simple processes for the segregation of the refuse and to produce the desired reclaimed products.

(ii)

Current Status		
CITIES	CLASS I	CLASS II
No. of cities	299	345
Total Population	1281138655	22375588
Waste generation (MT/d)	48134	1454
Mode of collection		
Manually	50%	78%
Trucks	49%	21%
Others	1%	1%
Disposal		
Dumping	94%	93%
Composting	5%	6%
Other	1%	1%

Source CPCB

(iii)

CHARACTERISTICS LAND-FILL LEACHATES			
Parameters	Concentration mg/l	Parameters	Concentration mg/l
pH	3.7 - 8.3	Lead	0 - 14.2
Tot Dis Solid	725 - 55,000	COD	50 - 99,000
Chlorides	2 - 11,373	BOD5	0 - 19,500
Tot Kj.Nitrogen	2 - 3,320		

Source CPCB

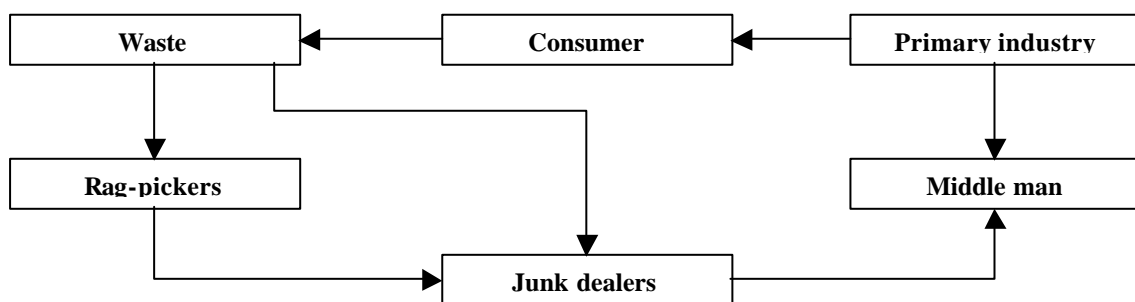
ROLE OF RAGPICKERS

A survey conducted by CPCB during 1996 in some of the cities, have revealed that 'ragpickers' play a key role in the management of garbage. They work day and night on the garbage dump sites to collect the recyclable materials. Some of the findings of CPCB on ragpickers are:

- Ragpickers were quite oftenly seen around waste receptacles engaged in picking up waste materials of their use.
- An excellent example of segregation of waste within dhalaos/dustbins, is provided by ragpickers, who make the living out of discarded materials.
- Ragpickers amongst themselves have good understanding for area-wise operation in the city.
- Ragpicking by children is a matter of concern.
- It has been observed that each group of ragpickers take specific item for segregation task.
- After segregation of waste, ragpickers either sell it to kabariwala or the recycling party.

An another study was carried out by the Garbage Farming and Ragpicking Institute of Wetland Management and Ecological Design, Caalcutta. It was observed that 77% of the ragpicking is being done by female workers and 85% rafpickers are illiterate. About 44% of ragpickers earn upto Rs.8/- per day and 13% of ragpickers earn Rs.18/- per day or little above.

Apporach with Rag Pickers



RECYCLING OF WASTES

Key Policy Issues

- Understanding the Economic Dimension of the Problem

ESTIMATED REQUIREMENT OF FUNDS FOR CAPITAL EXPENDITURE

Year	Urban Population (in million)	Cost/capita/year in Rs	Total cost in crore Rs. (US DM)
1995	244.60	70.00	1712.20
2001	295.00	76.00	2242.00
2011	395.00	86.50	3416.75 (750 DM)

- The Political Dimension

It is important to understand the political dynamics of the Mayorial System and its regional variants. One of the key problems is the politicization of the Solid Waste Management related issues due to political divisions in the Municipal Council.

- The Cultural Dimension

It is relevant to understand that graduation from an agricultural/rural to an industrial/urban society as in the Indian case and the laxity in attitude due to a high emphasis on personal hygiene vs community hygiene.

- The Managerial Dimension

Solid Waste Management is essentially a managerial issue and the mechanics of the process have not been simplified so far and need radical inputs of modern technology and systems of management and integration with other development partners.

THE ROAD AHEAD:

Efforts are being made that solid waste generated at different sites should not be allowed to be disposed anywhere and everywhere. Out of the waste generated recyclable waste should be stored separately and that primary collection system should ensure either doorstep collection or community based collection and this collection system should be synchronized with communal waste storage facility and transportation of waste in such a manner that multiple handling of waste is avoided. Decentralization of administration, adequate delegation of administrative and financial powers, training of staff, people's participation, levy of penalties and health care measures are being undertaken to make the SWM system effective and efficient.

Following further specific measures are being planned for improving and modernizing the Solid Waste Management Practices in the city:-

Storage Of Waste At Source

- ▲ ● Keep the street and public places clean is the responsibility of all. This motive can be achieved only with people's participation and co-operation.
- ▲ ● No Waste Shall Be Thrown On The Streets, Footpaths, Open spaces, Drains or Water Bodies.
- ▲ ● Waste shall be stored at sources of waste generation designated bins.
- ▲ ● Hazardous household waste should be kept separately from the above two streams of waste.

Segregation Of Recyclable/Non Biodegradable Waste

- ▲ ● The BMC has directed households, shops, establishments not to mix recyclable waste with domestic waste.
- ▲ ● These two categories of waste are to be kept in a separate bin or bag at the source of waste generation and collection itself.

Primary Collection Of Waste

- ▲ ● Domestic, trade and institutional food/bio degradable waste are to be collected on a daily basis.
- ▲ ● Recyclable waste and non-biodegradable waste other than toxic and hazardous waste are to be collected at regular intervals from the source of waste generation.
- ▲ ● Hazardous and toxic waste are to be deposited by the waste producer at specified places and not else where.

Sources of Information

- Bhopal Municipal Corporation
- Central Pollution Control Board
- Academy of administration, Bhopal