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## **Municipal Solid Waste Management at Amravati City - Present practice and future challenges**

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### **ABSTRACT**

The quantity of solid waste produced in city depends on the type of the city, its population, living standards of the residents and degree of commercialization, industrialization and various activities prevailing in the city. Due to rapid growth of population in Amravati municipal corporation area and changing life styles has resulted in increased waste generation. Consequently, waste management has become a key issue needing to be addressed. Amravati city generates about 184.90 tons municipal solid waste per day. The various Solid waste streams in Amravati city include municipal solid waste (households, commercial establishments), biomedical waste (hospitals, dispensaries), industrial waste (industries) and electronic waste (discards from electronic equipments including PCs). Handling of MSW is the responsibility of the Amravati Municipal Corporation (AMC) and Solid waste management strategies adopted by AMC includes management of MSW at compost depot, management of biomedical waste, and implementation of MSW rules 2000. But these present facilities are falling short and hence new Landfill site proposal is sanctioned for AMC.

The present paper is based on the study carried out on Solid Waste Management Practice by Amravati Municipal Corporation for Amravati City. The outline of existing situation of solid waste management system, problems associated with the system and the future requirement to handle the up growing situation are discussed.

### **1. Introduction**

Amravati is second largest growing industrial city in Vidarbha region, situated at 156 Km towards west from Nagpur. As so many other small cities in India, Amravati is growing in terms of living quality. New flyovers and roads are being built to renovate the city, and other improvements are going on. Amravati known as Indrapuri the capital of Lord Indra and named after ancient “Ambadevi” temple, which is famous for its ancient culture.

Solid waste Management (SWM) is a universal problem with Amravati being no exception. Over the years the city has grown significantly both in population and in density, which has resulted in great pressure being forced on the resources of the city, which in turn has contributed to an exponential increase in the generation of solid waste to a level which is beyond the city ability to cope. The quantity of solid waste produced in the Amravati city is mainly consists of residential area municipal solid waste and commercial area waste products. Disposal of increasing quantities of urban solid waste is a major challenge for Amravati Municipal Corporation. Resources are short. Amravati city generates about 184.90 tons municipal solid waste per day. The present method of solid waste disposal in the city has not

been satisfactory. The wastes are disposed in most unscientific way on to the land thereby posing threat to environment and public health.

## **2. Present Practice of Solid Waste Management at Amravati**

The proper collection and disposal of Solid waste without causing any harm to the environment is collectively termed as the solid waste management. The management of solid waste involves four steps. These are:

1. Generation and Composition of Waste
2. Collection of Waste
3. Transportation of Waste
4. Disposal of Waste

### **2.1 Generation of Waste**

In Amravati, there are 4 zones within which 81 wards are located. For sake of convenience of management of municipal solid waste, the waste generated, resources available etc. are referred to each ward and respective zonal office. The corporation performs its function as per the provisions of the Act governing the municipal corporation in the state. The table below shows the daily waste generation for each zone and ward based on population data. It is based on the assumption that 240 gram per person per day of MSW generation. The Table-1 below depicts the zone wise population and respective waste generation in tonnes per day.

**Table 1: Zone Wise Population and Total Solid Waste Generated**

Zone Number / Name	Population		Waste generation (TPD)
	2001	2005	
Zone – 1 : Rampuri Camp	126251	141558	42.47
Zone-2 : AMC Main office premises	159698	179060	53.72
Zone-3 : Hamalpura	167161	187427	56.23
Zone 4 : Badnera	96568	108276	32.48
	549678	616321	184.9

Therefore the total waste generated in Tons/day is 184.90.

According to a Newsletter titled “Urban Municipal Solid Waste Management” published by the National Solid Waste Association of India (dated Oct 2005) the per capita waste (gms per person per day) in Amravati is 274. Hence taking into account the population of Amravati, which is 6,20,000, the waste generated in gms in a day is  $(274 \times 6,20,000 = 169880000$  gms per day) i.e. 169.88 tonnes per day.

### **2.2 Composition of Waste**

A typical Solid waste comprises of biodegradable, non biodegradable and debris matter as given in Table 2 for Amravati city. The laboratory analysis of waste encompasses both physical and chemical characteristics and is given below in the form of tables. The physical characteristics of the MSW are depicted in Table 3 and the chemical characteristics of MSW are depicted in Table 4.

**Table 2:** Classification of Waste

Sr.	Type of waste	%Ton
1	Biodegradable	35.53
2	Recyclable	15.95
3	Debris and Silt	48.52

**Table 3:** Physical Characteristics of MSW

Sr.	Parameter	Value
1	Fruit /Vegetable waste	19.42 %
2	Paper	1.86 %
3	Plastic	8.92 %
4	Cloth	2.46 %
5	Wood	1.53 %
6	Metals	0.32 %
7	Glass	0.82 %
8	Leather	0.42 %
9	Rags	0.95 %
10	Rubber	0.06 %
11	Pebbles	13.82 %
12	Fine Sand	26.24 %
13	Ash and fine earth	21.18 %
14	Moisture	7.66 %
15	Density	440 Kg/cum

**Table 4:** Chemical Characteristics of MSW

Sr.	Parameter	Value
1	pH	8.17
2	ECE	2.842 Ms/cm
3	Organic carbon	11.27 %
4	Nitrogen as N	0.87 %
5	Phosphorus as P <sub>2</sub> O <sub>5</sub>	0.66 %
6	Calcium as Ca	0.72 %
7	Magnesium as Mg	0.48 %
8	C:N Ratio	12.95 %
9	Zinc as Zn	317 Mg/kg
10	Iron as Fe	15820 Mg/kg
11	Manganese as Mn.	186 Mg/kg
12	Copper as Cu.	360 Mg/kg
13	Lignin	11.5 %
14	Cellulose	9.55 %

### 2.3 Collection of Waste from Various Places

The collection of waste from various places is given in the Table 5. In addition to the above scheme of waste collection, there is provision of door-to-door collection of waste from approximately 90,000 nos of houses weighing approx 150MT. The provision of additional handcarts is envisaged for collection of waste from house to house.

**Table 5:** Collection of Waste from Various Places

1	Total existing places from where waste should be collected	Hotel: - 527	Beer bar: - 143
		Slaughter house: - 2	Community halls: - 70
2	Places from where places from where waste is actually collected	Hotel: - 150.	Beer bar: - 70.
		Slaughterhouse: - 2	Community hall: - 35.
		Vegetable market: - 5	Open spot: - 134
		No of containers placed in city: - 500 nos	
3	Resources of Special waste collection	Expenditure on transportation of total waste:- Approx Rs 1.80 crores.	
4	Expenditure for Total waste collection/ Income	Contract given for the collection of waste from hotels, community halls, and beer bars etc. AMC is collecting 18.5% royalty from the contractor per year.	
5	Remarks on Measures taken	Provision for collection of waste exists through handcart 11 dumper placers and 6 open trucks are being utilized for collection of waste and 500 containers have been placed in the city	

Some pictures depicting the present status of waste are shown in Figure 1 to 4.



**Figure 1:** Collection of Municipal Solid Waste



**Figure 2:** Container for Collection of Municipal Solid Waste



**Figure 3:** Scattered Municipal Solid Waste



**Figure 4:** Scattered Municipal Solid Waste at Fort Wall Gate

## 2.4 Transportation and Disposal of Waste

At present there is no technique of decentralized method of disposal of solid waste. The penalty is imposed on violation of rules from time to time. The transportation of waste up to compost depot at Sukhli road is done through open trucks and dumper placer is done, but not through decentralized technique. The total length of roads is approx 1000kms out of which 321kms of tar roads and 50kms of cement road is swept on daily basis. About 30 nos of penguin shaped bins and 40nos of litterbins have been provided for collection of waste generated by pedestrians. There is little bit improvement in the decentralized technique of waste disposal and secondary transportation the job being allocated to an agency.

## 2.5 Total Manpower and Infrastructure Deployed (for the Collection and Transportation of MSW by AMC)

The above activity i.e. collection and transportation of MSW is carried out both by contract basis and AMC itself. The total manpower bifurcated into the contractual labour and A.M.C manpower is : a) A.M.C employees – 799 and b) Contractual Labours – 685 The infrastructure deployed for the collection and transportation of MSW is as follows:

**Table 6:** Infrastructure deployed

Sr	Particulars of Infrastructure	No.
1	Handcarts	90 nos
2	Ganti Katla(mechanized)	200 nos
3	Ganti Katla (ordinary)	90 nos
4	M.O.H	1
5	Medical officer	1
6	Doctor Incharge	1
7	Sanitary Superintendent	1
8	Senior Sanitary Inspector	3
9	Sanitary inspector	23
10	Mukadam deployed	35

The total no of containers zone-wise is presented in Table 7. According to the data presented below in the Table below the most number of Dumper Containers (about

35%) are present in Rampuri Camp –1 while the most number of Ring type containers (about 37%) are present in Rampuri Camp –I. The most number of Open places where dumping is practiced is in Hamlapura (About 42%). The existing workforce and implements zone-wise is presented in Table 8 and the present disposal site is located at Sukli road, which has area of 27 acres and is located at 7 kms from the city.

**Table 7:** Total Number of Containers Zone Wise

Sr	Zone	Dumper Container	Ring Type	Open Place
1	Rampuri Camp – 1	166	52	28
2	AMC Main Office Premises	94	21	24
3	Hamalpara	137	32	53

4	Badnera	73	34	21
	<b>Total</b>	<b>470</b>	<b>139</b>	<b>126</b>

**Table 8:** Labour and Implements

Zone	Population 2005	Existing Workers	Existing Transfer vehicles	Existing Phawda	Existing Broom	Existing Basket
1	141558	320	49	166	136	185
2	179060	414	51	251	163	214
3	187427	458	63	254	204	267
4	108276	233	36	145	88	124
<b>Total</b>	<b>616321</b>	<b>1425</b>	<b>199</b>	<b>816</b>	<b>591</b>	<b>790</b>

### 3. Management of Solid Waste at Landfill Site

The disposal of solid waste is done at the landfill site, which is approx. 160- 170 MT (Photographs 5 to 7). The waste is dumped at compost depot and processing is done. The provision of generating biogas from waste and generating electricity from waste is proposed. The segregation of wet and dry waste is not carried out at the site and contract has been allotted for generation of manure and electricity. In addition to waste management at landfill site, the landfill site itself needs management as there is no provision of plantation, fencing, water and electricity and the provision of the same is suggested in the 12th Finance Commission.

#### 3.1 Management of Biomedical Waste

There is provision of management of biomedical waste of about 1 tons/day in

Amravati. The contract on BOO basis for regular collection/ transport and disposal has been allotted from date 1/01/2003 for the next 30years and the project is operating efficiently.

##### 3.1.1 Compliance of MSW Rules 2000 by AMC

#### 1. Prohibition of littering

For stopping littering A.M.C. has provided 500 closed containers and 120 fixed open spots.

#### 2. Collection and transportation of waste

At present there are 120, 00000 ie. 120 lakh households in Amravati city and approximately 90 %( door to door collection) of the waste from the households are currently being collected but the practice of segregation at source is not being currently practiced by A.M.C. The work of transportation has been given on contract basis.

#### 3. Processing of biodegradable waste

Vermi-culture is being currently practiced on small scale at two places. There is no decentralized technique adopted by A.M.C.

#### 4. Final disposal at Landfill site

The waste is being currently dumped at the landfill site.

## 5. Public awareness programs

The Corporation has taken various programs to create awareness among the local people regarding the significance of the solid waste management, which includes the following steps: - a) Pamphlets distribution b) Creating awareness through loudspeakers c) Door to door campaign d) Media publicity.

### 3.2 Enforcement of MSW Rules 2000 by AMC

The total revenue generation from imposition of penalties alone amounts to Rs 3 lakh per annum. The details of description of the offence and penalties thereby imposed based on the type of penalty is given in Table 9.

**Table 9: Penalties Imposed on the Type of Offence**

Sr	Description of offence	Penalty
1	Relieving oneself in public place	Rs 50/-
2	Throwing waste on roads	Rs 100/-
3	Spitting and spreading waste on govt. offices, public places and religious places	Rs 50/-
4	Disposal of hotel waste in public places or on road	Rs 400/-
5	Vendors spreading waste on public places	Rs 100/-
6	Hawkers related to vegetable and fruits spreading waste in public places.	Rs 400/-
7	All commercial establishment dumping waste in gutters, roads and public places	Rs 200/-
8	Cow dung etc on roads and public places	Rs 300/-
9	Dumping of industrial waste in public places	Rs 1000/-
10	Hospital clinical waste dumping on road, public places and open places	Rs 600/-
11	Construction debris dumping on road, public places and open places	Rs 1000/-

### 3.3 Problems with Current Solid Waste Management System

#### 1. General

1. There is shortfall of vehicles for the total collection of waste.
2. There is no initiative or co-operation forthcoming from the general public as regards the storage of waste generated from the household's everyday.
3. The collection is not hard and fast in the city.
4. There is difference of approx 25 tonnes of waste between the approx.160 tonnes of MSW transported for disposal as vis-à-vis approx 185 tonnes of waste generated which remains scattered and remains in the city either in the city or in unidentified places.
5. The complete waste is not collected from hotels, beer bars and community halls.
6. There is no classification of waste from house-to-house collection.
7. Lack of awareness and absence of comprehensive segregation of waste at source, resulting in large quantities of non-biodegradable waste being collected and sent to the facilities for biological processing



8. Absence of transfer stations for transferring MSW into bigger vehicles for transportation to the treatment and landfill facilities
9. Inadequate waste treatment capacity when compared to the quantum of waste generated
10. Dumping of MSW in drains, along the roads and in low-lying areas
11. Absence of policy and regulations to promote waste reuse and recycling and a favorable environment to promote manufacture of reusable material
12. Limited participation of the community in sharing the costs for SWM

## **2. Transportation of Waste**

1. There is shortfall of vehicles and waste containers but the waste stored from the handcarts is much more comparatively.
2. The waste stored from the handcarts is not classified at source into biodegradable and non-biodegradable components.

## **3. Disposal of Waste**

1. As there is no provision of processing of waste available, the waste is disposed off by land filling.
2. As there is no provision of classification of waste there is malodor from the landfill site.
3. As there is no provision of approach road up to land filling site the technique of disposal is not as per the norms.
4. There is no provision of vermicomposting of waste.
5. There is no adequate provision of water and electricity on the landfill site.
6. Adequate land is not available for land filling.
7. 628 nos. of organizations don't provide the biomedical waste generated.

### **3.4 Annual Expenditure on MSW**

The total expenditure pertaining to various services in relation to solid waste management system as per the information provided by AMC was about 12 to 13 Lacks The Proposed estimated expenditure for the year 2011-2012 is Rs 20 Lacks which is used for providing Well managed Landfill site and strengthening of existing facilities.

## **4. Future Challenges**

Given the population growth in Amravati, the key challenge for the AMC is to provide adequate MSWM services within its limited finances. MSWM services would require universal coverage since it has a direct bearing on the City's environment and citizens' health. The requirements for collection and transportation equipment and the estimate of tipping fee for composting and landfill are based on the waste generated and in turn the projected population as set out by detailed studies.

The estimated waste generation is expected to increase to in future base on the population growth forecasts. While the per capita waste generation is expected to increase with economic growth, various initiatives for segregation, recycling and reduction are proposed to



be implemented. As a result, the per capita generation coming into the municipal stream is estimated to be approximately 150 to 175 gm/day.

The strategy for improved service delivery would need to be concurrence with the MSW Rules 2000 while addressing the issues constraining the sector and its impact on the urban poor.

#### **4.1 Proposed Plan for MSW Management by AMC**

The New MSW Master Plan should be set out in compliance with MSW Rules, 2000 and the accepted waste hierarchy principles of reduction, reuse, recovery, and disposal. For long term planning following key principles should be followed.

1. Waste minimization at source
2. Waste management closest to generation
3. Generator to pay for management
4. Efforts for conversion of waste to energy should be made
5. Addressing social and environmental aspects

In the long term future plan of solid waste management for Amravati city the following points should be carefully considered:

1. Door to door collection at household level
2. Transportation to treatment and disposal facilities
3. Providing flexibility in MSW management for addressing local issues
4. Leveraging the existing initiatives including Swachha Amravati and experimentation on mechanical sweeping
5. Development of scientific MSW treatment (including waste to energy projects) and disposal facilities, and possible common facilities for AMC area.
6. Long term planning needs to incorporated w.r.t to new efficient solid waste management technologies and up gradation of present infrastructures so as to ensure 100% coverage and Individual involvement in collection and transportation
7. Specific / custom made vehicles including tricycles
8. Dumper bins at many extra community locations
9. Free service / subsidized user fees for supporting and helping MSWM plan
10. Strengthening of Implementation Framework

The following proposals have been approved by AMC: for the Phase – I.

1. Purchase of handcarts: 350 nos for collection of waste
2. Unit of sewer cleaning machine
3. Bobcat machine 1 nos
4. One Suction machine with vehicle
5. Two nos waste containers

## 6. Hydraulic auto & mobile vehicle

The following proposals have been approved by AMC: for the Phase –II

1. Bituminization of road towards Sukudi compost depot, construction of sewerage lines and cross drainage works
2. For purchase of bobcat machine (1nos)
3. For purchase of 3 Iron waste container 5m<sup>3</sup> purchase

As the responsibility for managing the MSW sector is the responsibility of the AMC, AMC should implemented projects with private sector participation in collection, transportation, treatment, and disposal. While treatment and landfill facilities are being developed under BOT framework but the implementing framework of AMC i.e. MSW Management Staff from worker to engineer all should be made aware about necessity, their role and responsibilities as a part of their duty. They should be trained and held responsible for improper management of MSW and implementation of strategies in the area allotted to them for supervision.

## 5. Conclusions

Solid Waste Management is a vital, ongoing and large public service system, which needs to be efficiently provided to the community to maintain aesthetic and public health standards. Municipal agencies will have to plan and execute the system in keeping with the increasing urban areas and population. There has to be a systematic effort in the improvement in various factors like institutional arrangement, financial provisions, appropriate technology, operations management, human resource development, public participation and awareness, and policy and legal framework for an integrated SWM system. To achieve Cleanliness, which is next to Godliness, it is necessary to design and operate an efficient SWM system. Public co-operation is essential for successful operation of such a system.

It is observed that present facilities for management of solid waste for Amravati city are falling short to cope with increasing population and increased waste generation. The Municipal Solid Waste Management at Amravati city as managed by AMC needed to be improved by adopting various. For Amravati City, on site segregation activity of Solid waste to separate dry solid waste and web solid waste should be improved to minimize the load on compost depot, Collection and Transportation facilities required to be strengthened by providing different category of extra collection vehicles as well as workers, existing compost depot and proposed Landfill site should be well planned and equipped with new technologies for disposal of municipal solid waste and thrust should be given on utilization of compost manure, recovery of possible materials for recycling, and landfill gas utilization for energy recovery.

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