Solid Waste Analysis and Proposed management Plan Pune

Abhijit D. Garad[a], Dr. S. B. Thakare[b]

Abstract: **There has been a significant increase in MSW (Municipal Solid Waste) generation in India in the last few decades. MSW generation is largely because of rapid population growth and economic development in the country. Solid waste management has become a major environmental issue in India. The per capita of MSW generated daily, in India ranges from about 100 g in small towns to 500 g in large towns. There is no national level data for Municipal Solid Waste generation, collection and disposal, over the years in our India. Municipal Solid waste management (MSWM) constitutes a serious problem in many third world Cities. Most cities do not collect the totality of wastes generated, and of the wastes collected, only a fraction receives proper disposal. The insufficient collection and inappropriate disposal of solid wastes represent a source of water, land and air pollution, and pose risks to human health and the environment. Over the next several decades, globalization, rapid urbanization and economic growth in the developing world tend to further deteriorate this situation. Items that we no longer need or don't have any further use are falling in the category of waste and we tend to throw them away. In early days people were not facing such big problems of disposal because of availability of space and natural material but now a day's congestion in cities and use of non-biodegradable materials in our day life create many problems. It is directly deals with our hygiene and psychology.**

Keywords: Solid Waste, Collection and Disposal, Solid waste management, recycling

I. INTRODUCTION

The civic services in the city of Pune are managed by Municipal Corporation of the City of Pune. Managing Solid Waste generated in the city - collection, transportation and its safe disposal is one of the most priority areas of attention for improvement of the Municipal Solid Waste Management in light of the MSW Rules 2000. Like most of the cities & towns in India, this service falls short of the desired level in Pune as the present systems adopted are outdated and inefficient to meet the standards (MSW Rules 2000). Lot of factors contribute to this present status, the main being lack of knowledge and improper choice of technology coupled with a lack of long term planning. It was necessary to address this problem systematically by going into all aspects of the Solid Waste Management (SWM) and devise a simple but cost effective system which must ensure desired level of collection, transportation and disposal of waste in an environmentally acceptable manner. Municipal Corporation of the City of Pune has therefore initiated the actions for upgrading all its MSW management systems in line with this concept to achieve the results envisaged under the Rules 2000. The schemes for various functional areas of the MSW management services are being developed as per the guidelines issued by the SWM Cell of GOM and AIILSG from time to time. This booklet gives a brief resume of the efforts in this direction in terms of an Action Plan and status of its implementation [1].

Solid waste management not only comes from industrial units. It also comes from various sources. Every man with the operation of daily domestic work creates solid waste for disposal. A study in united state shows that solid waste per person per day in 1920 is 1.2kg. It increases 2.3kg in 1970 and about 3.6 kg in 1980. This shows that solid waste per person is mounting due to number of reasons. Solid waste disposal creates a problem primarily in highly populated areas. The more concentrated the population. The greater the problem. City Solid waste generated Mumbai 6000 tones per day, Thane 700 tones per day. Hyderabad 2000 tones per day. Delhi 4000 tones per day. In India, generation of municipal solid waste (MSW), industrial, hazardous waste, biomedical waste have been increasing due to

- Solid wastes are all the wastes arising from human and animal activities that are normally solid and that are discarded as useless or unwanted. The term refuse, is often used interchangeably with the term solid wastes
- Any material that is discarded ,useless or unwanted is considered as a waste
- Waste management is the collection, transport , processing, recycling or disposal and monitoring of waste materials
- The solid waste management has the following components:
    - Identification of waste and its minimization at the source
    - Collection, segregation and storage at the site of collection

II. HISTORY OF SOLID WASTE MANAGEMENT

The population of Maharashtra as per 2001 census is about 9.68 crores, which comprises 4.1 crore Urban population. There are 250 urban local bodies (ULBs) in Maharashtra. This comprises 23 Municipal Corporations, 220 Municipal Councils, 3 Cantonment Boards and 4 Nagar Pachayats. Range of Per capita municipal solid waste generation in various towns of the state is in between 100 to 600 gram per day.

For class I cities in Maharashtra, the waste generation rates are in the range of 14 to 63 kg per capita per day, which includes Mumbai having the highest range of 0.63 kg per capita per day (pcpd). The average waste generation rate for the state is estimated as 35 kg pcpd.

As per the projection, the waste quantities are estimated to increase from 6.18 million tones per year in the year 2004 to 8.05 million tones per year in 2011 and 11.77 million tones per year in 2021. In total over 21632.3 tones per day

(TPD) of MSW is generated of which around 50% is generated in Mumbai (8500 TPD), Thane (680 TPD), Pune (1740 TPD) and Kalyan (1050 TPD). Compare to other Metropolitan cities in India, MSW generation is highest in Mumbai.

Available data indicates that, Waste generated in Maharashtra contains about 30% of Non-biodegradable components and 70 % of biodegradable components.

III. FUNCTIONAL ELEMENT OF SOLID WASTE MANAGEMENT

Waste generation:

1. Waste is generated at the start of the any process and therefore at every stage as raw materials are converted into goods for consumption.
2. For example-wastes are generated from households, commercial areas, industries, institutional, streets, cleaning and other municipal services.
3. Most important aspect of this part of SWM system is Identification of waste.

Waste Storage:

1. Storage is functional element because collection of waste never takes place at the source or at the time of their generation.
2. Following are the options for storage-
   1. Plastic container
   2. Conventional dustbins
   3. Used oil drums
   4. Large storage bin

Waste Collection:

1. It include not only gathering of solid waste and recyclable materials, but also the transport of these materials, after collection to the location
2. This location may be material processing facility, a transfer station or a landfill disposal site

Recovery and Recycling

1. These include various techniques, equipments and facilities used to improve both the efficiency of disposal system and recovery of usable material and energy
2. Recovery-It involves separation of valuable from solid waste, delivered at transfer station or processing unit.It also involve size reduction and density separation by air classifies, magnetic device for iron and screen for glass
3. Certain recovered material like glass, plastic, papered. Can be recycled as they have economic value.

Waste Disposal:

1. This is a final element of SWM
2. Disposal in ultimate rate of all solid waste, whether they are residential at waste semi-solid waste from municipal industrial waste, composts or other substance that have no further use to the society
3. Modern sanitary Landfills are a method of disposing solid waste without creating a nuisance and hazard to public health.

IV. SWM IN PMC

Sr. No.	Name & Address of Operating Agency	Capacity MT/Day	Method of Treatment
1	M/s Hanjar Biotech Energy Uruli Devachi Fursungi	500	Composting
		500	RDF(Refuse Derived Fuel)
2	M/S Rochem Seperation System Pvt. Ltd., Mumbai.Plot No. 86, TPS-2, Hadapsar Ind. Estate, Pune	700	Pyrolysis / Gasification
	Vermicomposting- 2 Sites		
1	M/S Ajinkya Bio Fertilizer. Hadapsar MSW Ramp	200	Vermicompost
2	M/S Disha Waste Management Pvt. Ltd.Hadapsar Ind. Estate Final Plot No. 87, Ramtekadi, Pune	100	Vermicompost
1	Pune Municipal Corporation. Hadapsar Ramp-II	5	Bio-Methanation
2	Pune municipals Corporation. Rajiv Gandhi Udyan, Katraj Ramp-II	5	Bio-Methanation
3	Pune municipal Corporation.Peshave Park-Ramp-1	5	Bio-Methanation
4	Pune Muncipal Corporation.Peshave Park-Ramp-2	5	Bio-Methanation
5	Pune municipals Corporation.Aundh Kachara, Ramp-1	5	Bio-Methanation
6	Pune Muncipal Corporation. Hole Road	5	Bio-Methanation
7	Pune Muncipal Corporation. Bawdhan kh	5	Bio-Methanation
8	Pune Muncipal Corporation. Model Colony	5	Bio-Methanation

9	Pune Muncipal Corporation. Parati , s. No. 67, 68 Taljai Pathar -I	5	Bio-Methanation
10	Pune Muncipal Corporation. Parati , s. No. 67, 68 Taljai Pathar -I	5	Bio-Methanation
11	Pune Muncipal Corporation. Katraj Ramp-III	5	Bio-Methanation
12	Pune Muncipal Corporation. Katraj Ramp-IV	5	Bio-Methanation
13	Pune Muncipal Corporation. Dhankavadi Trac Terminal	5	Bio-Methanation
14	Pune Muncipal Corporation. Aalandi Road	5	Bio-Methanation
15	Pune Muncipal Corporation. Vadgaon Sheri	5	Bio-Methanation
1	Pune Muncipal Corporation. M/S Excel industri , Aundh	2	Mechanical Composting
2	Pune Muncipal Corporation. M/S Save Environment , Ramtekadi.	2	Mechanical Composting

V. SOLID WASTE MANAGEMENT

Possible Waste Management Options
Methods of Treatment
Conventional Technologies
1. Composting
2. Vermicomposting
3. Anaerobic digestion
4. Incineration
5. Sanitary Landfill
Upcoming Technologies

6. Pyrolysis
7. Refused derived fuel (RDF)
8. Gasification
9. Bioreactor Landfill

At least 50% to 55% of municipal solid waste is also a valuable resource which can be recovered profitably using different technologies through following processing options:

Wealth from Waste

Organic fraction of municipal solid waste contains bio-degradable matter ranging from 30% to 55% which can be profitably converted into useful products like compost (organic manure), methane gas (used for cooking, heating, lighting, production of energy) etc. through the following processes:-

Waste to Compost

(i) Aerobic / Anaerobic Composting

Composting is a process of conversion of bio-degradable waste into stable mass by aerobic / anaerobic decomposition producing Carbon-di-oxide, Nitrogen, Phosphorous, Potassium etc. useful for soil fertility.

(ii)Vermi-Composting

Organic waste is stabilized through consumption by earthworms into worm castings which is known as vermi-compost and which is used as organic manure in agriculture.

Waste to Energy

Pillarization involves segregation of incoming waste into high and low calorific value materials, shredding them separately to uniform size, reducing its moisture content, mixing them together and making into pellets / briquettes which are used for producing thermal energy.

(i) Refuse Derived Fuel (RDF) / Pillarization
(ii) Bio-methanation
(iii) Incineration
(iv) Pyrolysis / Plasma Gasification

Refuse Derived Fuel (RDF) / Pillarization

Pillarization involves segregation of incoming waste into high and low calorific value materials, shredding them separately to uniform size, reducing its moisture content, mixing them together and making into pellets / briquettes which are used for producing thermal energy.

Bio-meth nation

Segregated garbage undergoes anaerobic digestion producing methane gas and effluent sludge. Bio-gas production ranges from 50 M^3 – 100 M^3 / MT of wastes. The gas is utilized for heating applications / dual fuel engines / steam turbines for generation of power. Sludge after stabilization can be used as soil conditioner.

Incineration:

Process of direct burning of wastes in the presence of excess air at temperature of about 800 ^0C to 870 ^0C, it liberate heat energy, inert gases and ash. The process is power intensive and used for bio-medical waste management.

Pyrolysis / Plasma Gasification:

The process of thermal decomposition of organic waste for energy recovery using plasma arc torch producing temperatures between 5000 ^0C and 14000 ^0C for heating of waste and converting into gaseous form. The process is cost-intensive and can be used for hazardous waste / bio-medical waste only.

Recycling of Waste (Plastics, paper, glass, metal etc.)

Recyclable materials like paper, cardboards, plastics, polythene bags, pieces of metals and glass are recycled to recover useful resource.

Sanitary Landfilling :

Rejects from compost plants, recycling and other inorganic materials like construction debris in Municipal Solid Waste are sent to scientifically engineered landfills.

Total Vermicompost That Can Be Obtain From Pune-

Total Waste generated in Pune city = 1800 tons/day

- 60-70% of food and garden waste is available in total waste

Total food and garden waste available per day = 1800 * 0.65

= 1170 tons

- Compost obtained from the solid waste = 1170*0.4

= 468 tons

- Estimated cost of 1 Kg of compost =Rs. 2/
- Estimated cost of 468 tons of compost = Rs. 9,36,000
- Income that can earn by PMC per day =Rs. 9,36,000
- Income that can earn by PMC per anum = Rs34,16,40,000 /-

(Approx. 34 crores)

Therefore, by managing the wet waste generated in Pune city can earn Rs 34 Crores per annum, which is a considerable amount for providing better services in PMC.

VI. CONCLUSION

Waste generation and waste reduction reflect many complex economic and social factors. No city or town can adopt recommendations in a vacuum; each must examine its own wastes, and the potential for extending waste reduction. There are many possible ways to implement the general dictum that waste reduction should be the first principle of solid waste management. Humane concern for waste workers must temper the drive to greater efficiency. During periods of technical change, there are winners and losers, and in the field of materials recovery there should be attention to those who lose out as operations become more efficient. In most cases, the resulting municipal strategy will be a mix of private and public sector activities.

Two decades of economic growth since 1990 has changed the composition of Indian wastes. The quantity of MSW generated in India is increasing rapidly due to increasing population and change in lifestyles. Land is scarce and public health and environmental resources are precious. The current SWM crisis in India should be approached holistically; while planning for long term solutions, focus on the solving the present problems should be maintained.

Inform citizens about source separation and recycling, and the needs of waste workers: extensive public education is needed to develop understanding of the need for further source separation to improve the potential for composting and to remove the stigma of association with waste materials. Energy recovery can be done from solid waste. We should adopt the methods, which can recover energy from solid waste. Increase awareness in peoples through interesting programs.

If we manage solid waste effectively at-

1. Residential 2. Markets

3. Institution 4. Garden and Parks

5.Commercial 6. Treatment plant

Then, No Landfill will be required for Organic Waste

ACKNOWLEDGMENT

It give me great pleasure in presenting the report.

I would like to thank Guide and Principal Dr. S. B. Thakare for providing all the facilities related to our report.

I would like to also thank Head of Department (M.E. CIVIL)- Prof. S. M. Gawande for wholeheartedly helping and directing in my project work.

I would also like acknowledge my wholehearted gratitude to my guide Prof. S. M. Gawande for his inspiration and guidance without which it would have been difficult for me to complete the seminar report.

Last but not the least; I would also like to thank the Civil Department Staff Members, College Library Staff Members & College Staff.

REFERENCES

1. Akolkar, A.B. (2005). Status of Solid Waste Management in India, Implementation Status of Municipal Solid Wastes, Management and Handling Rules 2000, Central Pollution Control Board, New Delhi.
[2]. Asnani, P.U. (2004). United States Asia Environmental Partnership Report, United States Agency for International Development, Centre for Environmental Planning and Technology, Ahmedabad. (2005). Technical Committee Report, West Bengal SWM Mission 2005, Government of West Bengal, Kolkata.
[3]. Municipal Solid Waste (Management & Handling) Rule, 2000:
[4]. MOUDPA (2000). Manual on Solid Waste Management, Ministry of Urban Development and Poverty Alleviation, Government of India Publications, New Delhi.
[5]. GOI (2003). Report of the Technology Advisory Group on Solid Waste Management, Government of India Publications, New Delhi.
[6]. MOUDPA (2000). Manual on Solid Waste Management, Ministry of Urban Development and Poverty Alleviation, Government of India Publications, New Delhi.
[7]. Maharashtra non-biodegradable garbage (control) act 2006:
[8]. Maharashtra plastic Carry Bags (Manufacture and Usage) Rules 2006:
[9]. Local bodies status- Maharashtra Pollution Control Board
[10]. State of Environment Report- Ministry of Environment & Forest 2009
[11]. http://www.wikipedia.com
[12]. http://www.unep.or.jp/ietc/estdir/pub/msw/
[13]. http://edugreen.teri.res.in/
[14]. http://en.wikipedia.org/wiki/Waste_management
[15]. http://www.cpcb.nic.in

Bibliography of Authors

Abhijit D. Garad[a] has been completed graduation in 2010 and currently working as Lecturer in Department of Civil Engineering, Sou. Venutai Chavan Polytechnic, Pune since Dec. 2013. He is pursuing his postgraduate dissertation work in Anantrao Pawar College of Engineering & Research under the guidance of author[b].

Dr. S. B. Thakare[b] has been awarded Doctorate in 2006. He worked as Lecturer and Head of Department in Vidya Prathishtan College of Engineering, Baramati. Presently he is working as Principal of Anantrao Pawar College Of Engineering and Research, Pune. He has been guided several graduate and post graduate project works in environmental engineering continuously.