

**REVIEW OF SOLID WASTE MANAGEMENT IN INDIA****Er. Amit Bijon Dutta**

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**ABSTRACT**

Solid waste refers to refuse the solid semi solid waste matters of a community except the night soil. Solid waste contains organic as well as inorganic matters. Solid waste management includes the entire process of dealing with solid waste, starting from the collection from the primary source to ultimately disposing off it hygienically, so that it may not be a nuisance or create any harmful effect on nearby community. The solid waste management involves, management at waste generation level, storage at the source of generation, primary collection, street cleansing, temporary storage at locality level, regular and periodic transportation of this temporarily collected waste to disposing sites and treatment plants. The per capita waste generation rate is strongly correlated to the gross domestic product (GDP). Waste generation rate in Indian cities ranges between 200 - 870 gms/day, based on the lifestyle of the regions and the size of the municipality. Generation rate per capita waste is rising by about 1.3% per year in India. The hierarchy of waste management recognizes that reducing the use of materials and reusing them to be the friendliest to environment. Source reduction begins by means of reducing the amount of waste generated and reusing materials to prevent them from entering the waste stream. Thus, waste is not generated until the end of "reuse" stage.

**KEYWORDS:** Solid Waste Management, Street Cleansing, Transportation of Waste, Environmental and Health Impact.

**INTRODUCTION**

Solid waste refers to refuse the solid semi solid waste matters of a community except the night soil. Solid waste contains organic as well as inorganic matters. Solid waste management includes the entire process of dealing with solid waste, starting from the collection from the primary source to ultimately disposing off it hygienically, so that it may not be a nuisance or create any harmful effect on nearby community. The solid waste management involves, management at waste generation level, storage at the source of generation, primary collection, street cleansing, temporary storage at locality level, regular and periodic transportation of this temporarily collected waste to disposing sites and treatment plants. As per Municipal solid waste Management and Handling rules -2000, solid waste management is in the obligatory function of urban local bodies, but in actual practice the solid waste management is given the last priority and the duties are either not performed or poorly performed consequently the city has to face numerable problems related to environment and sanitation.

As per the reports of the committee constituted by the Hon'ble Supreme Court of India in March 99, the lack of financial resources, inefficient institutional arrangement, inappropriate technology, weak legislative measures and unawareness in public towards solid waste management has made the service most unsatisfactory and inefficient. The solid waste management approach in India is extremely inefficient, using old and obsolete system, technology for storage collection processing, treatment and disposal. There is no formal organized system of segregation of biodegradable and non biodegradable solid waste. The recovery and recycling of waste is only done by scavengers and scrap dealers which is highly hazardous to those which are involved in this job.

**THE ENTIRE SOLID WASTE MANAGEMENT CAN BE DIVIDED IN FOLLOWING ACTIONS**

1. Generation of Solid waste
2. Collection of solid waste at primary source
3. Street Cleansing
4. Transportation of solid waste to the secondary/ locality storage/community bins



5. Storage of solid waste at locality level
6. Transport of solid waste to dumping sites and treatment plants
7. Treatment and Dumping of Solid Waste
8. Traditional approaches of dealing with solid waste

### GENERATION OF SOLID WASTE

Following are the major sources of generation of waste at urban level

- 1- Solid waste from Residential Areas , Institutional/ Community areas
- 2- Solid waste from vegetables markets (retail & wholesale)
- 3- Solid waste from Hotels , and restaurants
- 4- commercial areas Solid waste
- 5- dispensaries & hospitals Biomedical waste
- 6- Waste from domestic / stray animals /dairies
- 7- Solid waste from Industries
- 8- Waste from street cleansing
- 9- Miscellaneous

### PER CAPITA MSW GENERATION

The per capita waste generation rate is strongly correlated to the gross domestic product (GDP) of a country (Table 1). Per capita waste generation is the amount of waste generated by one person in one day in a region or nation state. Rate of increase in waste generation rises with GDP. Countries with high income generate more waste per person compared to low income countries. The per capita waste generation on an average in India is 370 gms/day as compared to 2,200 gms in Denmark, 2,000 gms in US and 700 grams in China

<i>Table 1 : Comparison between the per capita MSW generation</i>	
Country	Per Capita Urban MSW Generation (kg/day)
	1999 - 2025
Low Income Countries	0.45 - 0.9 0.6 - 1.0
Middle Income Countries	0.52 - 1.1 0.8 - 1.5
High Income Countries	1.1 - 5.07 1.1 - 4.5

Waste generation rate in Indian cities ranges between 200 - 870 gms/day, based on the lifestyle of the regions and the size of the municipality. Generation rate per capita waste is rising by about 1.3% per year in India.

<i>Table 2: Highest and Lowest Waste Generation and Waste Generation Rates Among Metros, Class 1 cities, States, UTs, and North, East, West, South regions of India</i>					
		Waste Generation (TPD)		Per Capita Waste Generation (kg/day)	
		LOW	HIGH	LOW	HIGH
METRO	Value	3,344	11,520	0.445	0.708
	City	Greater Bengaluru	Greater Kolkata	Greater Bengaluru	Chennai
CLASS-1 CITIES	Value	317	2,602	0.217	0.765
	City	Rajkot	Pune	Nashik	Kochi



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All Cities	Value	5	11,520	0.194	0.867
	City	Kavarati	Kolkata	Kohima	Port Blair
States	Value	19	23,647	0.217	0.616
	State	Arunachal Pradesh	Maharashtra	Manipur	Goa
Union Territories (UT)	Value	5	11,558	0.342	0.867
	UT	Lakshadweep	Delhi	Lakshadweep	Andaman & Nicobar
Regions	Value	696	88,800	0.382	0.531
	Region	East	West	East	West

Cities in Western India were found to be generating the least amount per person waste, only 440 gms/day, followed by East India (500 g/day), North India (520 g/day), and generation rate of Southern Indian cities is about 560 gms/day, the maximum per person waste generation. Minimum and maximum per capita waste generation rates States are Manipur (220 grams/day) and Goa (620 grams/day). Manipur is an Eastern state and in Western Goa and both are small states comparatively. Were as bigger states, per person in Gujarat generates 395 g/day; followed by Orissa (400 g/day) and Madhya Pradesh (400 grams/day). States generating large amounts of MSW per person are Tamil Nadu (630 g/day), Jammu & Kashmir (600 g/day) and Andhra Pradesh (570 g/day). Among Union Territories, Andaman and Nicobar Islands generate the highest (870 grams/day) per capita, while Lakshadweep Islands (340 grams/day) generates the least per capita. Waste Generation Per capita in Delhi, the biggest Union Territory is 650 g/day. (Source: Sustainable Solid Waste Management in India, by Ranjith Kharvel Annepu)

### ECONOMIC GROWTH, CHANGE IN LIFE STYLES AND EFFECT ON MSW

The waste generation rate generally increases with increase in GDP during the initial stages of economic development of a country, because increase in GDP increases the purchasing power of a country which in turn causes changes in lifestyle. Even a slight increase in income in urban areas of developing countries can cause a few changes in lifestyle, food habits and living standards and at the same time changes in consumption patterns. Therefore, high income countries generate more waste per person compared to low income countries due to the difference in lifestyles.

### HIERARCHY OF SUSTAINABLE WASTE MANAGEMENT

The Hierarchy of Sustainable Waste Management (Figure 1.0) developed by the Earth Engineering Centre at Columbia University is widely used as a reference to sustainable solid waste management and disposal. For the specific reason of study, "Unsanitary Land filling and Open Burning" has been added to the original hierarchy of waste management which ends with sanitary landfills (SLFs). Unsanitary land filling and open burning will represent the indiscriminate dumping and burning of MSW and represents the general situation of SWM in India and other developing countries.



**Figure 1.0: Hierarchy of Sustainable Waste Management**

The hierarchy of waste management recognizes that reducing the use of materials and reusing them to be the most friendly to environmental. Source reduction begins by means of reducing the amount of waste generated and reusing materials to prevent them from entering the waste stream. Thus, waste is not generated until the end of “reuse” stage. As the waste is generated, it needs to be collected. Material recovery from waste in the form of recycling and composting is recognized to be the most effective way of managing waste. Due to technological and financial limitations of recycling; product design; inadequate source separation; and lack of sufficient markets that can use all sorted material, for the most part of the MSW generated in India ends up in landfills. Local establishment have to start working with their partners to promote source separation. At the same time as this is being achieved and recycling is improved, provisions should be made to handle the non-recyclable wastes that are and will be generated in the future. A sustainable solution to handle non-recyclable waste is recovery of energy. Energy recovery from wastes falls lower than material recovery. Land filling of MSW is equal to burying natural resources which could be used as secondary raw materials or as energy source. However, in the present civilization, landfills are required as a small fraction of wastes will have to be land filled. However, unhygienic land filling or open dumping of wastes is not considered as an option to handle MSW and is not at all recommended.

#### **PROBLEMS OF STORAGE OF SOLID WASTE AT THE SOURCE OF GENERATION**

- ✓ In most of the cities in India , the scientific and systematic storage of waste at source is not in practice .
- ✓ The waste is normally thrown in nearby vacant areas ,government vacant land ,drains, streets etc .
- ✓ Because of waste thrown on the street the environment becomes ugly and unhygienic , so even in case of regular cleaning be Municipal Workers
- ✓ also, the city cannot be kept clean for more than 2-3 hours .
- ✓ At sources people generally don't arrange to provide proper dustbins , in residential , institutional and commercial areas .
- ✓ In case of open drains and large drains passing across the city , people throw waste and these drains are clogged , width of large drains are reduced because of continuous dumping,
- ✓ People generally use following items to collect waste at source : buckets ,polythene packets, plastic bins , metal bins with and without lids.



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- ✓ People generally don't take the waste to the designated points they carry it to nearby roads , railway tracks , open plots etc and generally people avoid walking to the designated disposal points .
- ✓ So when wind blows the heap of solid waste get carried away by wind and spread in large areas and when there are rain the problem get aggravated.
- ✓ There is no scheme for keeping the Bio degradable and non Bio degradable waste separately
  - No processing of the waste is done in most cities . Very few cities have the organizational and administrative set – up to subject the waste to treatment process like composting and that too on a very limited scale . Most of the wastes are disposed by the concerned agency at an open dump without going in to the details of either site or wastes. There is no adherence to any standards or norms for disposal and the sites is not scientifically managed .
  - The land filling practice in most Indian cities is one of the most unscientific and unhygienic practices with serious environmental implications . The wastes are brought to the site and dumped . There are no consideration for leach ate , gases and cove. The land fill sites are mostly accessible to scavengers , animals and vectors .

### STREET CLEANISING

The major sources of street waste in the city are –

- 1- Natural waste comprising of dust , decaying vegetation , fallen trees leaves , blossoms , seeds , plants and animals .
- 2- Road traffic waste like oil , rubber , accidental spillage of load of vehicles , animals dropping construction waste etc .
- 3- Waste from nearby areas / population from residential area , commercial areas , industrial areas etc .
- 4- Litter thrown by pedestrians waste from houses , hotels , establishments , excreta of animals , pets like pigs ,cattle , dogs etc .
- 5- Waste produced by street hawkers , road side vegetables vendors , slum dwellers .

### ACTIVITIES INVOLVED IN TRANSPORTATION OF WASTE

Movement of vehicles to various temporary storage points.

- ✓ labour-intensive loading of waste using baskets and or other lifting arrangements.
- ✓ Lifting of waste from the open yards on the way to the disposal site and
- ✓ Transportation till the disposal site

It is very critical to synchronize the whole operation of collection of waste with the transportation for effective management of the waste and for achieving economy in the process.

### PROCESS OF TRANSPORTATION OF WASTE

In India generally the smaller cities have adopted open transport system for transporting the waste from the temporary storage points to the dumping site . Wastes are collections are from various temporary storage points and open collection points and are loaded manually to the transport vehicles . Manual loading is time consuming and reduces the productivity of the vehicles and man power deployed for the reason . Additionally , manual loading and handling of wastes are posing threat to the health of sanitary workers , as the wastes were found highly contaminated. As a result ,the waste is generally seen lying in heaps or scattered at the unscientifically designed temporary waste storage points giving unsightly appearance besides causing nuisance and unhygienic environment . Preferably for the manual loading , the man power required is about 3 sanitary workers including Driver . One sanitary worker shall fill the basket with the waste and another to dump into the cargo of the vehicle . For lifting operation, the sweeper who is in operation near the storage site may be used.



### ASSESSMENT OF ENVIRONMENTAL AND HEALTH IMPACT

There are potential risks to environment and health from improper handling of solid wastes. Direct health risks concern mostly the workers in the field; they need to be protected, to the fairest possible, to make direct contact with wastes. Specific risks in handling wastes from Clinics and hospitals. For public in general, the main risks to health are indirect and arise from the breeding of disease vectors, primarily flies and rats. The significance of Environment and Health Impact Assessment is aimed at improving the information support for proper management of municipal solid waste.

In many places waste recovery is an important unorganized and or organised private industry employing many thousands of scavengers who may live or work on refuse dumps. These groups of people are termed to as human scavengers or waste pickers and are frequently ignored in urban project plans although their activities may be vital to the life of the city. Many consist of abandoned kids and needy families. They live and work under extensive health risks, which are mostly un-documented, and suffer severe exploitation and deprivation. Potential health hazards consist of raised levels of infant mortality, hand and leg injury, infection in eyes, intestine and respiration, lower back pain, undernourishment, skin disorders and exposure to hazardous waste. Drinking and washing, Water supply, and sanitation facilities are usually very poor at dumpsites. Health and welfare facilities are should be provided.

### TREATMENT AND DUMPING OF SOLID WASTE

The main objective of treatment and disposal is to clear waste from the disposal site in an environment friendly manner with little/ non serious implication on the health and hygiene of the micro and macro environment. It is accountability of the local body to ensure safe disposal of the waste generated within its authority. The urban local bodies have generally adopted dumping as method of the disposal of the waste as on today. Currently the waste is not treated in systematic and scientific manner. As a consequence the whole area in and around the disposal site has become un-hygienic and posing serious threat to the public health.

### PROBLEMS OBSERVED IN THE PROCESSING AND RECOVERY OF SOLID WASTE

1. Generally in Indian cities the formal processing and recovery units are not established
2. Recovery and recyclable activities restricted to small and medium kabadi wallas
3. Involvement of small children and old people employed for sorting and segregating waste.
4. No protective clothing /consideration for rag pickers / scavengers
5. Generally in Indian cities financial implications of recovery and recycling has not been studied or considered to use solid waste for the purpose of finance generation

### EMERGING PROCESSING TECHNOLOGIES

Established techniques such as composting, incineration, etc., various new methods are being developed for processing of municipal solid waste. All these methods reduce the pollution potential & quantity of solid waste requiring to be disposed off and also sometimes result in recovery of some by products having potential use

- ✓ Vermicomposting involves the stabilisation of organic solid waste through earthworm consumption which converts the material into worm castings.
  - ✓ When municipal solid wastes with a large proportion of organic matter is subjected to anaerobic decomposition, a gaseous mixture of Methane & Carbon di-oxide ( CH<sub>4</sub> & CO<sub>2</sub> ) known as biogas could be produced under favorable conditions
  - ✓ Alcohol Fermentation, this is a developing technology applicable to cellulosic biomass. It involves anaerobic decomposition of cellulosic organic matter by Ethanologic bacteria to produce mainly Ethanol.
  - ✓ Pyrolysis involves an irreversible chemical change brought about by the action of heat in an atmosphere devoid of oxygen. Synonymous terms are thermal decomposition, destructive distillation and carbonisation.
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- ✓ Refuse derived fuel, the process of conversion of garbage into fuel pellets involves primarily drying, separation of combustibles from garbage, size reduction and pelletisation after mixing with binder and/or additives as required.

### CONCLUSION

Solid waste refers to refuse the solid semi solid waste matters of a community except the night soil. Following are the major sources of generation of waste at urban level, Solid waste from Residential Areas, Institutional/Community areas, Solid waste from vegetables markets (retail & wholesale), Solid waste from Hotels, and restaurants, commercial areas Solid waste, dispensaries & hospitals Biomedical waste, Waste from domestic / stray animals /dairies, Solid waste from Industries, Waste from street cleansing and Miscellaneous. The waste generation rate generally increases with increase in GDP during the initial stages of economic development of a country, because increase in GDP increases the purchasing power of a country which in turn causes changes in lifestyle.

The major activity of SWM is Street Cleansing, Activities Involved in Transportation of Waste, Process of Transportation of Waste, Assessment of Environmental and Health Impact and Treatment and Dumping of Solid Waste. The main objective of treatment and disposal is to clear waste from the disposal site in an environment friendly manner with little/ non serious implication on the health and hygiene of the micro and macro environment. It is accountability of the local body to ensure safe disposal of the waste generated within its authority. Established techniques such as composting, incineration, etc., various new methods are being developed for processing of municipal solid waste. All these methods reduce the pollution potential & quantity of solid waste requiring to be disposed off and also sometimes result in recovery of some by products having potential use.

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