



MAKING
the most of a

M E S S

A Handbook on
Municipal Solid Waste

Srishti is an environment group registered as a society. It is involved in issues regarding the environment, waste, toxicity and communities. Srishti envisions a comprehensive waste management policy, which would include public participation, a packaging policy and producers' responsibility to take back non-biodegradable and toxic waste and opt for cleaner materials and products.

Toxics Link is a non-profit environmental organisation working towards a toxics free world. Operating since 1996, Toxics Link has three information outreach nodes in Delhi, Mumbai and Chennai. The nodes provide information to grassroots groups, organisations and individuals as well as networks working on environmental toxicity issues.

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THROWN OUT! MUNICIPAL WASTE

Overview

Environment is a word that conjures up different images in our mind, mostly images about Nature - forests, animals, trees, landscapes, etc. But environment is everywhere. It is the whole system in which we co-exist and interact with other living beings. The food we eat, the clothes we wear, the cars we ride in, and the books we read, are all related to the environment. Every kind of human development has its positive or negative effect on the environment. For instance more demand for food could mean more areas to be brought under cultivation that in turn may mean more forests to be cleared, or more animals being raised for procuring meat.

Similarly, a rise in the demand for cars would lead to more production of steel that may again lead to burning of more coal spurring a rise in the emission of greenhouse gases. On the other hand, initiatives like use of solar and wind energy could lead to reduction in demand for electricity from coal and hydro power plants, thereby positively impacting our environment. Composting of biodegradable garbage also helps in better management of our municipal waste by reducing the quantity of garbage to be landfilled.

Undeniably, our environment is closely linked to our life styles. The way we live has rapidly changed, especially over the past century. Our dependence on nature has seemingly declined. It is a fact that many of us are unable to relate nature to our lifestyles anymore. No longer do many of us ; urban folk need to fetch water from wells or rivers or grow food ourselves. Water comes to us from an elaborate water supply system, while food is delivered to us by markets, shops and vendors, often after being processed. Nothing is wrong with it. Nobody expects us to go and fetch water from rivers or dig a well in our garden or for that matter grind our own flour.

But the question remains, although we have distanced ourselves from nature, have we really become less dependent on it, now that our lifestyles have become highly consumerist? We consume a range of things from essentials to those that are not so essential in our lives.



For example, take the simple shirt we wear. The shirt is wrapped in a plastic bag to prevent it from getting dirty. Then the shopkeeper puts it another bag that has the name of the shop. Once we wear the shirt we discard both the plastic bags as they are of little use to us. The irony is that these plastic bags will continue to pollute even after our shirt has become a rag. Many of the human activities related to production of goods or services leave behind such by-products at every stage of their manufacture that actually harms our environment.

By-products continue to be generated even after the product is finally consumed. At times the product itself at the end of its useful life adds to the by-products already existing in the environment, the adverse effect of which lasts for years.

What are these by-products? There is a more friendly term for them - waste. Waste, as we all know, is something that is seemingly of little or no use to us and has to be discarded.

Waste is produced only as a result of human activity. Ever heard of an Elephant wrapping his/her bamboo in plastic bags or a tigers killing more prey that they can possibly eat! No other creature in nature produces waste that later on poses a problem to the environment. If we were to take

a walk through a forest, we will not get to see anything that may be called waste, by virtue of it not being used by the creatures living in the forest. The leaves that fall on the forest floor are converted to manure by microorganisms unlike in cities where it is burnt or ends up in landfills. Similarly carrion left by animals like tigers and leopards is eaten by scavengers like vultures and hyenas. "The birds, the insects and the animals of field and forest contribute their wastes and eventually their bodies, helping to grow food so that more of their kind may prosper. The greenness of the earth itself is strong testimony to nature's continuing composting programme." (The Rodale Book of Composting, ed. D.L Martin and G. Gershuny.)

Humans too are a part of nature like all other living beings. They play an important, perhaps a more important role, in sustaining it as they have exploited it the more than the other beings. The results of our wasteful consumption are

quite easily visible. Look inside a municipal dustbin and we will come across a wide array of waste most of which come from our homes. One will find wrappers, shoes, bottles, paper, plastics, cans, boxes, automobile parts, glass, wires, and numerous other things – virtually supermarket, although none of us would like to pick up things from there!

Although waste seems to be invariably generated by human activity, it is something that we can reduce without really affecting our quality of life. It is not really a necessity. In the later sections of this book we will be looking at waste, the problems related to it and try to find what we can do to minimise it. It will be about loads of rubbish that we will be talking about -

Hope you enjoy it!



OPENING THE BIN

An introduction

No matter where and how we live, we create waste. The phenomenon of waste generation is not something recent. Waste has been produced ever since humans have populated the face of the planet, although the nature of waste, the ways to handle it, and the problems associated have changed drastically over decades. Cities all over the world have a problem with waste being accumulated by their respective populations and some of them have had to engage with it since ancient times.

Let us step back in history to get a feel of garbage through the ages

Prehistoric times

nomadic folks and waste

Early humans were often nomadic, living in small groups for a given period in one area and then moving on to a new location. The trash they left behind would either rot away or be removed by scavengers. The trash that did not qualify



as biodegradable then, mostly comprised of stone tools and weapons. These, however, would not build up to troublesome levels before the nomadic families moved on. Small population of indigenous cultures continue to live such a lifestyle even today in increasingly fewer parts of the world. As human beings began renouncing a nomadic life and started settling down permanently, they began to devise ways to deal with the trash they generated.

Ancient civilisations

municipal laws, garbage dumping in rivers, garbage collectors, composting, recycling, sewerage systems



- For a long time, early civilisations had no systematic method for getting rid of waste. Much of the garbage ended up in pathways. When the stench became overpowering, a fresh load of dirt or clay would be spread over the garbage with the result that it increased the heights of floors and roadways. In Troy, Greece, this practice made it necessary to raise roofs and change doorway openings (Rathje and Murphy, 1992). The first “town dump” was a brainchild of the ancient Greeks. Around 500 BC, the Greeks organised municipal dumps, established compost pits and instituted laws that required wastes to be dumped one mile away from the city walls. About the same time in Athens, the first known law against throwing trash into the streets was issued. (Eblen and Eblen, 1994).

- In Egypt, waste, collected mainly from the wealthy citizens, was dumped into the Nile river.

- By the 2nd century BC, the Chinese had established a workforce that gathered garbage in major cities.

- Ancient Mayans had dumps meant for organic waste and they actually reused materials like broken pottery and other household debris as fill for buildings.

- Rome, because of its huge sprawl, was not able to manage its waste efficiently and much of it remained dumped on the streets. After the fall of the Roman Empire, many towns that were small and more rural in character had enough land available for waste disposal. But as cities began to build up again, waste disposal problems increased.

- Nearer home, the Harappan civilisation had an elabo-

rate system to manage their sewage. Nearly every Harappan home had a bathing platform and a latrine. Some Indus Valley cities reached heights of 40 feet in part because of their concern about hygiene. In the Indus Valley, homes were also periodically elevated to avoid the risk of runoff from a neighbour's sewage. Each neighbourhood had its own well, and elaborate covered drainage systems to carry dirty water outside the city.

The Middle Ages

open dumping, epidemics, street cleanings

■ In several urban areas during the Middle Ages, waste was still discarded in the streets, giving rise to extremely filthy conditions in densely populated areas, with pigs running through the streets scavenging the garbage.

■ People walking in the streets were in danger of being bombarded by garbage tossed out of the windows and doorways. Not only was this practice unsightly and unsavoury, but also outright unhealthy. Although people couldn't figure out the connection then, but this trash and filth actually contributed to the spread of the Black Death or the dreaded bubonic plague that devastated the European population. Towards the end of the Middle Ages, sanitary conditions began to improve because of the development of paved roads and street cleaning in cities.

The Industrial Revolution

urbanisation, slums, waste dumping on streets, industrial waste, waste management, incinerators

■ With the advent of the Industrial Revolution, sanitation practices declined as city populations increased. Throughout the 1700s and 1800s, European and American streets were clogged with waste due to rapid urbanisation coupled with growth of



slums. Animal wastes, and the waste from burning fuel in homes and industrial furnaces, added to the existing trash. Diseases and epidemics increased during this time. The threat of diseases finally led to changes in sanitation practices and to the systematic collection of garbage.

■ During the late 1700s in Philadelphia, US, Benjamin

Franklin implemented sanitation services in the form of street cleaning and some trash removal. Also rag pickers made their appearance. They retrieved bits of cloth to be sold and used for making paper. Around this time, many Americans began

digging refuse pits instead of throwing out the trash in the open. In New York city, trash used to be dumped in the East river.



Garbage incinerators began to be used in 1870s in England and USA (Rathje and Murphy, 1992, A). However, problems with incompletely burnt trash and difficulty in burning wet trash like kitchen waste made the process more expensive and its use declined. Incinerator use was replaced by 'reduction', a process that "stewed" wet garbage and carcasses in vats, creating a liquid that was used as fertiliser or for making other industrial products like soap. Reduction too, eventually declined because of the overpowering stench associated with process.

Early 1900s

public health systems, organised street cleaners, change in garbage composition, advent of packaging, inefficient waste disposal

■ Near the turn of the 20th century, Western civilisations began to realise that disease-causing germs came from garbage and not from the smells associated with it. To respond to the problem, cities began their own first public health systems. Regular trash collection and street cleaning were established. This period also saw change in the composition of garbage. The component of manure, ash and carcasses in the trash declined and was replaced by food wastes, packaging materials like detergent boxes, and disposable products like paper cups and paperback books. Collected waste was usually carried out to open dumps,

dumped in water, and used to fill ravines or burnt in open pits. But all of these methods continued to create problems.

Mid-1900s

increase in volume of trash, sanitary landfills, combustion, air pollution, disposable items



■ New methods of waste disposal were tried in this period. Waste began to be dumped in sanitary landfills. Combustion of trash again gained currency as it reduced the volume of trash to be handled. But this began to affect the air quality. Both landfills and dumps were filling up faster as lifestyles were changing towards the use of more convenience-

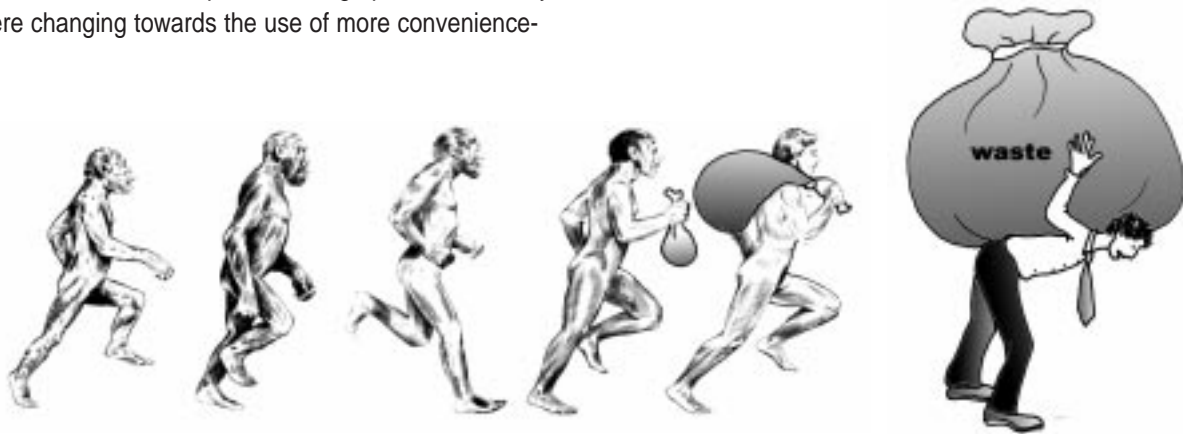
oriented products, disposable items and increased product packaging. Reuse of materials declined. Many of the items that ended up as garbage were dangerous to the environment as there was a marked increase in the use of chemicals and other hazardous materials in the products.

Late 1900s

citizens more aware, recycling, environmental regulations

■ By this time, citizens started playing an important role in waste management by using recyclables, practising composting and reducing waste. Environmental consciousness continued to heighten but so did the amount of garbage. Regulations were developed to protect people and the environment from pollution generated from waste. But the problem persisted and newer ways of solving it continued to evolve.

The above section except on Harappan Civilisation has been extracted from "Exploring Environmental Issues: Municipal Solid Waste", American Forest Foundation Washington DC, USA



Managing waste is a challenging task and as our cities grow it will become indeed more complex. Waste and the problems associated with its disposal are urban concepts, especially in a country like India. In rural India most of the waste that is generated are biodegradable in nature like agricultural waste, animal litter, food scraps etc. This waste is either composted or fed to the animals. The rural folk manage their waste by themselves for there is no municipality or a local body taking care of it. One does not in fact, come across huge garbage dumps with rotting waste in villages, a common sight in the cities. However, with growing consumerism, disposable items like plastic bags, bottles and packaging waste have also started making its appearance in most parts of rural India.

What is waste?

Ministry of Environment and Forests (MoEF), Government of India, defines municipal solid waste (MSW) as

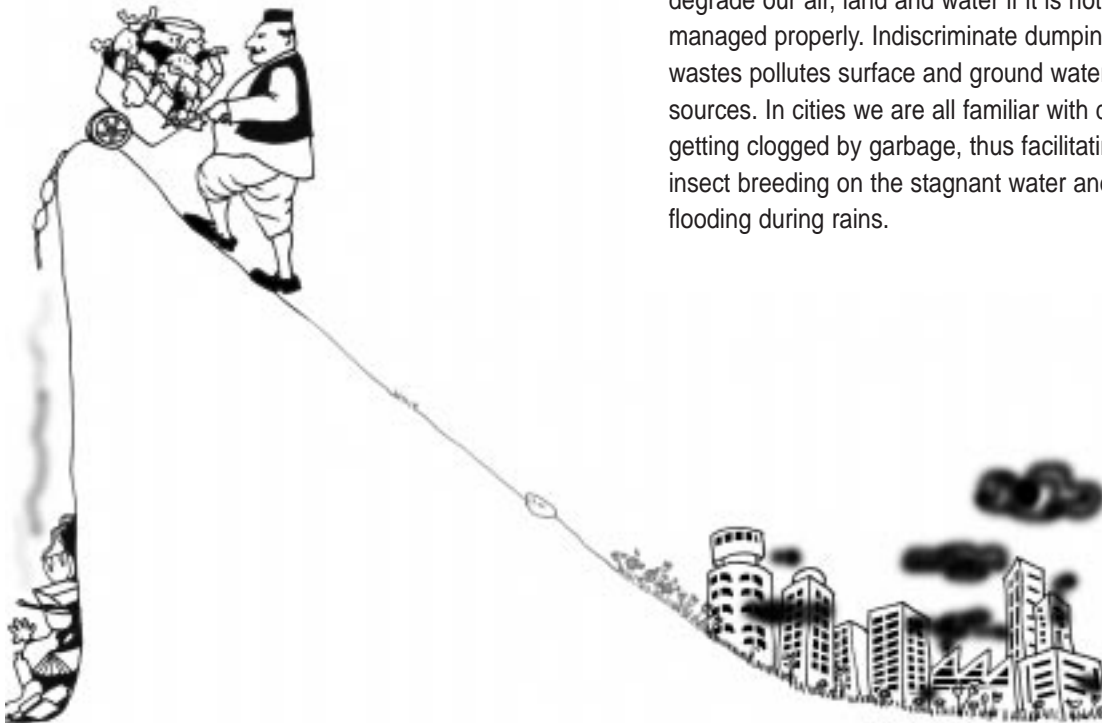
“Municipal solid waste includes commercial and residential wastes generated in a municipal area in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes.”

Putting it simply, any material that is discarded because it has served its purpose or is no longer useful, is called solid waste. These are wastes from homes, offices shops, hospitals etc.

India, as it urbanises, produces large quantities of waste. In 1991, urban India produced 23.86 million tonne of waste. In 2001 it is estimated that it will produce almost 40 million tonne of it. If one thinks that is a small amount, it actually means 20,000,000 truckloads of waste.

Why solid waste needs to be managed efficiently

■ Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead

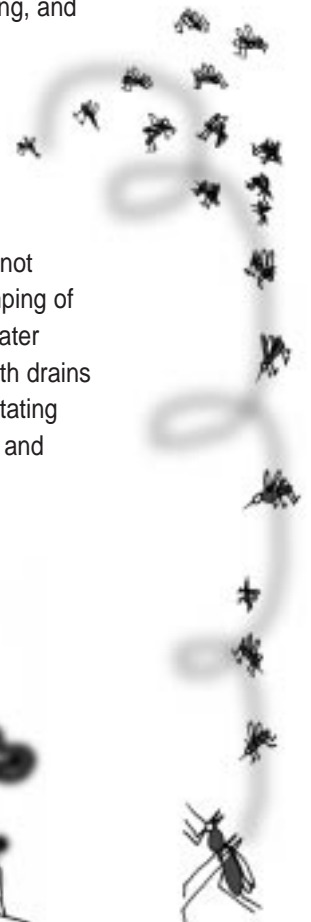


Every product we consume has a hidden history, an unwritten inventory of its materials, resources and impacts. It also has attendant waste generated by its use and disposition. The amount of waste generated to make a semiconductor chip is over 100,000 times its weight; that of a lap top computer, close to 4,000 times its weight. One tonne of paper requires the use of 98 tonne of various resources.

– Life in Plastics, page 326, by Robert Edwards and Rachel Kellet – Other India Press (Hawken, Lovins and Lovins, National Capitalism: The Next Industrial Revolution: Earthscan Publications Ltd (London), 1999.

to pollution of the environment and to outbreaks of vector-borne disease (diseases spread by rodents and insects). The tasks of collecting, treating, and disposing of solid waste poses a wide variety of administrative, economic, and social problems that must be managed and solved.

■ Solid waste has the potential to degrade our air, land and water if it is not managed properly. Indiscriminate dumping of wastes pollutes surface and ground water sources. In cities we are all familiar with drains getting clogged by garbage, thus facilitating insect breeding on the stagnant water and flooding during rains.



■ Garbage burning contributes significantly to urban air pollution. Greenhouse gases are generated from decomposition of organic wastes in landfills and untreated leachate pollutes surrounding soil and water bodies.

■ 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 to such waste and can spread diseases like cholera and dengue fever. Using water polluted by solid waste for bathing, irrigation and drinking can also expose individuals to disease.

Ragpickers and municipal waste handlers even in big cities like Mumbai, Delhi, etc. are seldom protected from direct contact and injury from waste. At times, hazardous waste dumped from hospitals into municipal bins poses serious health threat to waste workers by exposing them to deadly diseases like HIV, hepatitis B, tetanus, etc.

We have by now got a brief overview of municipal waste. In the coming pages we shall talk about its various aspects in detail.



References:

What a waste, Solid Waste management in Asia, World Bank

Exploring environmental issues: Municipal Solid Waste (Project Learning Tree, Washington DC)

Municipal Solid Wastes (Management and Handling) Rules, 2000, Ministry of Environment and Forests, Government of India

DELHI - WHAT A MESS!

Delhi is an ancient city. It was first founded more than 1,000 years ago when King Anangpal Tomar made Delhi his capital. After that the city saw many successive dynasties and empires make it their home. The present Delhi or New Delhi is a vast city. Delhi is home to more than 1 crore people, many of whom have come from different parts of the country in search of a better life. The city has been continuously expanding, from just a few square kilometers at time of King Anangpal Tomar to more than 1,400 sq km today.

Although 1 crore people have the privilege of living in the capital city, 49 per cent of them have to live in slums or the so-called unauthorised colonies. Proper water supply, electricity, sewage and other civic amenities that most of us take for granted are often not available here. But then, Delhi still is growing at a frantic pace.

Wherever there are people, it is a certainty that things would get used and discarded. All of us consume things: we buy vegetables, food, clothes, books; we travel by buses, cars, trains, and we need electricity in our homes, schools, offices, and hospitals. But consumption becomes a problem when it puts strain on our natural resources and the consequent waste it leaves behind.

Delhi – the garbage garble

Big metropolises like Delhi produce huge quantities of garbage every day. We do not really know how much waste we are generating every day. The following tables and graphs may give an idea about this.

According to an estimate by a former Deputy Registrar of the Census of India, in the year 2021 more than 2 crore people would be living in Delhi.

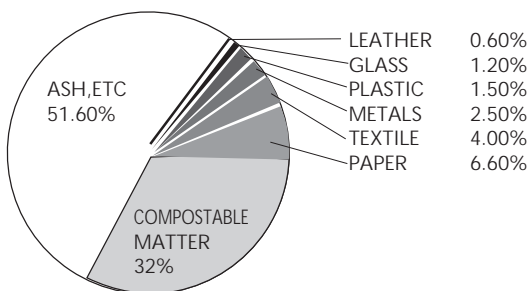
CRORE PEOPLE

Garbage Generated in Tonne per day

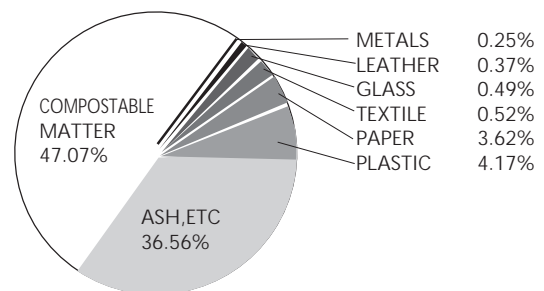
Quantity	Says Who
4,000	Central Pollution Control Board (CPCB) - 2000
4,600	Solid Waste Management in Delhi. An Exploratory Study on Local Government – Community Interface. Institute of Social Sciences, New Delhi, 2000 (Source: CPCB, 1995) 2000)
5,000	White Paper on Pollution in Delhi (1999)
7,000	Delhi Urban Environment and Infrastructure Improvement Project. MoEF and Planning Dept., Government of NCT of Delhi (January 2001)
8,230	A Fact Sheet by the National Capital Regional Planning Board (Delhi, 1999)

Composition of Municipal Solid Waste

CENTRAL POLLUTION CONTROL BOARD, 2000



DEPARTMENT OF STATISTICS



Future scenario in Quantity of Waste Generated:

Year	National Capital Regional Planning Board, Delhi - a fact sheet	Regional 1999	Ministry of Environment & Forests & Govt. of Delhi, Planning Department, January 2001
2011	11,899		NA
2021	13,676		17,000 – 25,000 tonnes per day

From the above tables and graphs, the discrepancy is quite apparent. There is a difference of opinion amongst various government agencies about the quantity of waste generated and, the composition of waste and the future waste generation scenario. In such a situation it is difficult to formulate a definite policy on waste.

A city like Delhi produces waste that is diverse in nature. Let us briefly look at the various kinds of waste besides municipal waste that we city dwellers help generate



Medical Waste

Delhi has hundreds of healthcare establishments that include hospitals, nursing homes, clinics, blood banks, veterinary hospitals, etc. All these establishments generate substantial amount of potentially infectious waste. It is estimated that 80 metric tonne (MT) of medical waste is produced by the capital's various healthcare institutions. Around 10-15 per cent (9-12 MT) of this waste is highly infectious. Besides comprising soiled bandages, used cotton, pathological and anatomical waste, the hospital waste also includes used syringes, tubes, bottles and various plastic and glass material. Although it

forms only a small proportion of the total waste, it has the potential to contaminate the huge amount of municipal waste generated if not disposed off according to the norms. This type of urban waste poses dangers to the health not only of the rag pickers, but also to that of municipal workers, who handle waste regularly. Although the government has issued norms making it mandatory for hospitals to segregate infectious and non-infectious waste, their implementation is questionable. Medical waste needs to be treated separately before disposal, The Ministry of Environment and Forests (MoEF), Government of India, formulated the Bio -Medical Waste (Management and Handling) Rules, 1998, to this effect, and all health care establishments in the country are bound by this law.

Construction Waste

As our cities grow so does the demand for offices, houses, markets, roads etc. Old buildings are demolished to construct new ones, roads are widened by breaking old pavements, new buildings are constructed to accommodate more people and offices. Such activities generate a high volume of construction and demolition waste, popularly called 'malba' (rubble). Malba, characteristically, is voluminous and is often carelessly dumped on roadsides, back lanes or into nallahs (drains) adding to the ever burgeoning problem of waste.



Industrial Waste

Delhi has a large number of industrial units, numerous factories and recycling units located all over the city. Though industrial waste is technically not a part of the bulk of the municipal waste, it nevertheless is a burden on the municipality. Many industries in the city do not manage their waste according to the norms. They dump their waste casually along with municipal waste. Industrial waste that can be highly toxic in nature, has the potential to contaminate municipal waste to a degree that can further increase the hazards it may pose to the environment. There are no good estimates available that can tell us the amount of industrial waste that is flowing into the municipal waste stream. But according to the CPCB (Central Pollution Control Board), the amount is almost 200 tonne per day on solid waste basis.



Who generates what

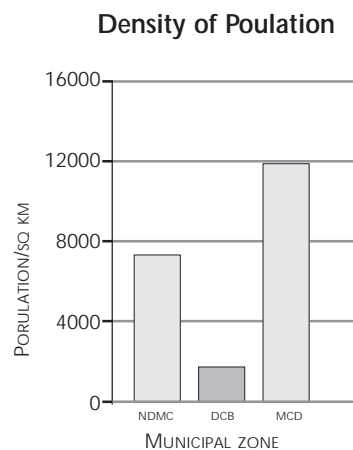
Waste generation is however not a uniform process. There is a wide variation in the amount and nature of waste that a Delhi citizen generates. According to a study conducted in Delhi jointly conducted by Srishti and the TERI (Tata Energy Research Institute), people in higher income brackets having a monthly income of Rs 8,000 and above, generate about 800 gm of waste per capita every day, whereas, people living on an monthly income of

Type of Waste	Income up to Rs 2,000 per month	Income more than Rs 8,000 per month
Organic	72%	82%
Grit	14%	Negligible
Plastic	5%	8%
Paper	5%	9%
Glass	4%	1%

Rs 2,000 per month generate just 200 gm of waste per day –that is four times less! Not only does the quantity vary, but there also is a variation in the composition of waste.

Characteristics of solid waste also vary considerably among communities and nations. American refuse is usually lighter, for example, than European or Japanese refuse. In the United States, paper and paperboard products make up close to 40 per cent of the total weight of municipal solid waste while food waste accounts for less than 10 per cent. The rest is a mixture of yard trimmings, wood, glass, metal, plastics, leather, cloth, and other miscellaneous materials. These figures vary with geographic location, economic conditions, season of the year, and many other factors.¹

Responsibility of clearing this mound of waste that we produce falls under three municipal bodies of the city. They are, the Municipal Corporation of Delhi (MCD), the New Delhi Municipal Committee (NDMC) and the Delhi Cantonment Board (DCB).



The MCD services 95 per cent of Delhi, whereas the NDMC and the DCB (exclusively for the cantonment area) equally service the rest.² Not only is the area under the MCD the largest, the density of population within its zones is also far greater than the other two zones. The areas under the NDMC primarily constitute government colonies, diplomatic areas, and some five star hotels and hospitals, where the population has remained more or less constant.

Similarly, the DCB area services the military cantonment of the city and there too, the population has not risen substantially. Moreover, these two areas have not witnessed the construction boom that has happened in other parts of the city. These municipal bodies play limited, but nevertheless an important role in the collection of the garbage we generate that passes through several stages from our homes to landfills.

From bins to landfills stages in garbage management

Household collection

Most of us are familiar with the normal process of garbage collection from our houses. A sweeper or the domestic help usually takes away the garbage we generate from our houses to dump it in bins. These days many residential areas have their respective Resident Welfare Associations (RWA) that have actively undertaken door-to-door collection of garbage and its transportation to the municipal collection point. These initiatives are fast gaining momentum and are poised to play a major role in managing waste in future.

How is your garbage taken away? Have you employed a person to do it? Do you yourself, or one of your family members, do it? Does the RWA of your colony supervise it? Check it out to find what happens to your garbage after it has left your house.

civic ills of our cities. True, Yamuna Pushta may not be as clean as Janpath or Race Course Road, but we need to reflect a little deeper into it the reasons for this. Locations like Yamuna Pushta often do not have any facility for collection of waste from the households and it is the responsibility of the households to dispose their garbage in municipal bins. Even municipal bins are not always present in these areas and the lifting of garbage from such areas is also not a priority with the municipality. Can these people, who are economically not well off, afford the services of a sweeper or afford the subscription to run RWAs? The prime responsibility lies on people like us who generate most amount of waste. This however, does not mean such areas should not be clean or people living there can be absolved of their responsibility towards waste. What is needed here is suitable interventions in this regard.

Secondary waste collection

Once our garbage has reached the primary collection point that may be an open dump or a waste bin called dallows, it now lies there patiently waiting to be picked by the municipal corporation, in its all-illusive truck.

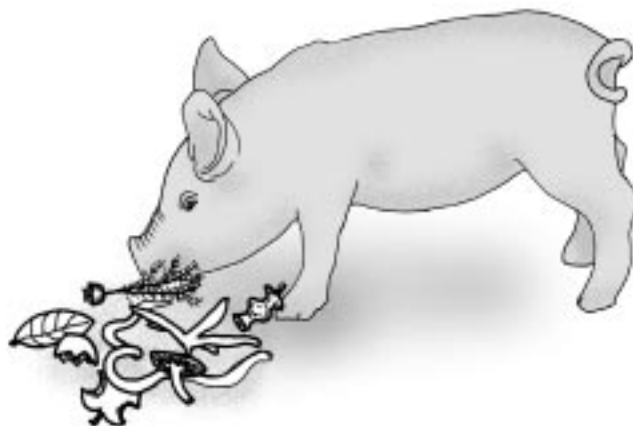
Thankfully, the garbage does not lie unattended! Cows, crows, dogs, pigs, rats, mosquitoes, and flies come to feast on it. In Delhi, according to an estimate, just 60 per cent of the waste gets picked up.³

At this stage we also need to look at a very serious and sensitive issue that is directly connected to our garbage generation.



We are lucky that we have options to manage our waste. Although, there are still quite a few of us who, despite having access to facilities, just throw the garbage out on the streets and expect it to be taken away. And if it is not taken away, we raise a stink about how inefficient our system is!

We often tend to blame people living in jhuggis (slums) and unauthorised clusters as prime culprits for furthering the



³ Delhi 1999 A Fact Sheet. National Capital Regional Planning Board

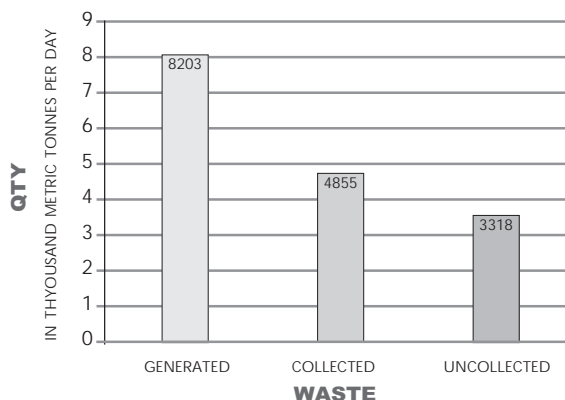
Have you come across people –many a times young children - carrying a sack on the back and rummaging through garbage and putting it in their sacks? We may have often turned up our noses at them and walked away thinking what dirty people they are rummaging away in ankle-deep filth. They are the rag pickers - often marginalised in our society, just about managing to survive. They are actually reducing our waste thereby lessening the burden of the municipality. In Delhi alone, there are 100,000 rag pickers who take away approximately 10-15 per cent of the waste. Rag pickers collect different recyclable items like plastic bags, metal cans, wires, paper, plastic items, etc., and sell it to local kabariwallas (scrap dealers) who again sell them to recycling units located in different parts of the city. Rag pickers are very poorly paid. Most of them do not earn more Rs 40-50 per day. Rag picking is not a formally recognised profession, and our municipal authorities are undecided on how to handle them, although their job is apparently eased to some extent by these rag pickers.



Rag picking is not only a thankless profession, but also dangerous. Our municipal waste often comprises hazardous items from hospitals, industries and homes. Scavenging through waste dumps gives these rag pickers cuts from sharp things like needles and glass. If these sharps happen to be from a medical unit, rag pickers can contact Hepatitis, HIV and other deadly infections. They can also get infected by fecal matter that is always present in the waste dumps. Constant bending over to pick up waste may also lead to severe back problems. Besides, rag pickers may also get bitten by rats, dogs and insects that inhabit the dump area.

Some rag pickers extract copper wire from discarded PVC wire by burning it. The resulting dioxins are highly poisonous and are known to cause cancer. Due to their poor socio-economic condition they do not even have access to proper medical facilities to counter these dangers.

Waste Generation and Collection



Delhi 1999 A fact sheet: National Capital regional planning board

The municipal bodies are been unable to clear all the waste that the city generates

Waste lying in the open is not only an eyesore, but is also a major health and environment hazard. Ground water and soil get polluted if toxins in the garbage leach out. Outbreaks of vector-borne diseases (that is, diseases spread by rodents and insects) can also occur. The Surat plague of 1994 was caused by garbage that was left uncollected on the streets for days.

Waste also poses a great threat to people who handle it. How many of us can put our hand in a bin that is full of



waste. The reaction to this suggestion would almost immediately be that of shock and horror. Well, there are people who literally handle our waste. Most municipal workers do it, even if they have no protective gear like shoes, gloves, aprons, caps, masks, etc. They usually shovel the waste in baskets, haul it over their heads to throw it into the trucks. During the process, they may get pricked by sharp objects in the waste or have waste all over their bodies (no showers for them to clean up afterwards!). These municipal workers are continuously exposed to the garbage and carry the risk of contracting diseases easily.

Once our garbage has spent its time in the dumps, it is time for municipal bodies to take charge for its disposal. The Central Pollution Control Board (CPCB) has listed the following technological options for municipal solid waste disposal:

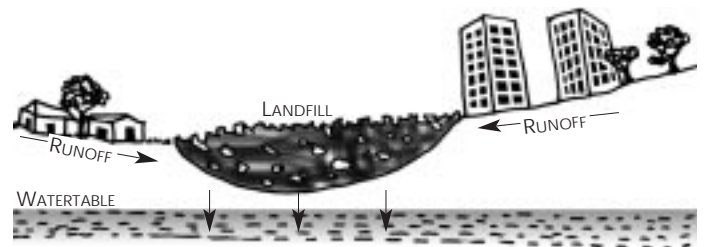
- Sanitary landfill
- Incineration
- Biomethanation
- Composting
- Fuel pelletisation

In smaller municipalities, none of the above methods are

followed because of resource constraints. Garbage is simply dumped in low-lying areas on the outskirts of the town.

Sanitary landfilling

Sanitary landfills are huge dumping grounds located mainly on the city's outskirts. Ideally, a landfill should be lined to prevent leachate leaks that pollute underground water and soil. It also needs to have an elaborate system of pipes and tubes to avoid forming landfill gas. Waste dumped in landfills is compacted and covered with earth. Methane rich gas, also known as landfill gas, is produced during anaerobic decomposition of the waste. However, none of the landfills in Delhi are either lined or have provision for gas recovery. They are unscientifically managed. Leachate from landfills can contaminate the soil and water with toxins like lead, arsenic, mercury, cyanide, etc. In Delhi, about 98 per cent of the garbage is disposed off in landfill sites. Delhi has three landfill sites - Gazipur, Bhalaswa and Okhla. These sites are filling up fast and will not last beyond the current decade. New sites are being planned at Tajpur, Jaitpur, Goeshalla, and near village Sultanpur and village Deoral.



DIGGING DEEP

We think once our organic garbage has reached landfills it will decompose and mix with soil. Really?...



William Radje is an American archeologist interested in digging up other things besides history. He undertook to explore a closed landfill and came up with rather interesting artifacts. During his explorations he found almost completely preserved lettuce, magazine covers and newspapers. Landfills are compressed to accommodate more garbage; this cuts out the supply of oxygen and hence preserving even the biodegradables. One lesson to be picked from his findings is that it is better to find ways of composting waste instead of letting it go the landfills and hope that it breaks up there.

Source: Our Ecological Footprint, CSE

Incineration - Vent for Waste

Burning of waste. It seems an easy way out to make our waste disappear into thin air. Burning of leaves, garbage, and other waste is a common practice. Burning apparently reduces the volume of waste to be disposed thus making our tasks easier. Incineration is quite akin to burning, but instead of open burning where small quantities are burnt at a time, in incineration large quantities of waste are burnt under controlled condition in an Incinerator.

Incinerator technology has evolved over the years. From simple kilns of yesteryears to sophisticated machines of today equipped with array of pollution control devices and designed for specific purposes like municipal solid waste, hospital waste, industrial waste, etc. This however, does not end the problem. Incinerators have inherent drawbacks, the most potent being the emissions of dioxins and furans.



Dioxins and Furans

To produce dioxins we need organic matter, chlorine and reactive thermal environment - an environment that an incinerator readily provides.

- Dioxins and furans are among the deadliest chemicals known to us. They are the potent carcinogens - cancer-causing agents.
- Dioxins are produced when chlorinated compounds e.g. from garbage, medical waste and

toxic chemicals are burnt in an incinerators.

- Since dioxins dissolve in oils, fats etc. they bioaccumulate up the food chain
- Dioxins are transported through atmosphere and deposit on soil, plants water bodies, etc.
- Dioxins contaminate air, water and food passing these deadly pollutants on to people through meat, milk and fatty food products.
- Despite their potency dioxins are either not monitored or very poorly monitored in most countries.

Source: Molecules of Death; Down to Earth, August 31, 2001

Biomethanation. This is suitable when organic matter that is separated and fed into the bioreactor. Here in the presence of methanogenic bacteria and under anaero-

bic conditions, fermentation takes place and biogas is produced. In addition, high quality organic manure in the form of sludge, which may be dried, is also obtained.

Waste segregation Selective Municipal Solid Waste (MSW) collection systems that segregate the waste at source, could reduce the amount of waste destined for landfilling. The separating out of paper, glass, textiles, and plastics from MSW would not only reduce household waste but also help conserve materials and energy. Having separated out the useful fractions of MSW, the next step is to ensure adequate and environment friendly reprocessing facilities for the secondary raw material and a market for products made with recycled products. Currently this activity is carried out in the informal sector by rag pickers, kabaris and illegal recycling factories in India. This needs to be propped up though the availability of safer technologies for recycling as well as recognising and supporting the role rag pickers play in this crucial task.

– No Fire Without Smoke.

A Critical look at Municipal and Hazardous Waste Incineration, Srishti, 1996





Composting. Composting is the decomposition of plant remains and other once-living materials to make an earthy, dark, crumbly substance that is excellent for adding to plants or enriching garden soil. It is the way to recycle our kitchen waste and garden waste like plant cuttings, leaves, etc. It is an excellent method which

most of us can adopt as the critical step in reducing the volume of garbage that is sent to landfills for disposal.

Composting facilities are relatively cheap and easy to operate. They can reduce the total amount of municipal solid waste by 40 per cent thus reducing the amount of garbage to be disposed of in landfills. Composting can be carried out individually or commercially. Some composting facilities can only process organic matter and thus require the waste to be pre-sorted. Industrial composting often includes separation equipment and allows organic matter such as sewage, sludge and manure to be reprocessed.

No Fire Without Smoke.

A Critical Look at Municipal and Hazardous Waste Incineration Srishti, 1996

Vermicomposting: Here specially bred earthworms are introduced into a shallow pit where they act upon the garbage and reduce it to an excellent manure. Learn about these worms in the coming pages.



Refuse-Derived Fuel Pelletisation - RDF

This technology involves various processes to improve physical and chemical properties of solid waste. RDF systems are used to separate municipal solid waste into combustible and non-combustible fractions. Using raw unprocessed waste as fuel gives problems due to heterogeneous material that varies from suburb to suburb and season to season. It also has low heat value but high ash

and moisture content.

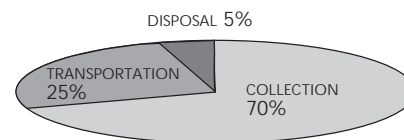
Waste with high organic (carbon) content is suitable for briquetting and pelletisation after non-combustible and recyclable materials have been separated. The process involves compaction of waste at high temperature and pressure. The organic matter is compressed in a die to produce briquettes or pellets.

Waste Care

Waste too needs to be cared for. If we leave it lying in the open dumps, the results are there for us to see. Waste care is an important issue for any community especially the urban, as the issue is not only linked to environment but also to jeopardising of public health.

As our country progresses economically, the consumption pattern of the population also changes. Nowhere is the impact more obvious than in the volume and nature of waste we generate. Due to lack of serious efforts by town/city authorities, garbage management has now become a burning issue and this is despite the fact the largest part of municipal expenditure is allotted to its management. Waste management services employ a large number of work force. For e.g. about 26 per cent of the Municipal Corporation of Delhi's employees are *safai karamcharis*.⁴ Although municipalities spend a substantial amount on waste management, it is evident the amount is

Distribution of expenditure on waste



not properly distributed or utilised.

The above graph brings forth an important fact - proper disposal is not a priority with us. Final disposal costs are also minimal because disposal is usually accomplished through open dumping. Ahmedabad for e.g., spends 86 per cent of its solid waste budget on collection, 13 per cent on transportation and only 1 per cent on final disposal.⁵ On an average garbage collection efficiency in an Indian city ranges from 50 –90 per cent.⁶ Proper disposal of solid waste is not only an absolute necessity for the preservation

⁴ *Solid Waste Management in Delhi*. An Exploratory Study on Local Government - Community Interface. Institute of Social Sciences, New Delhi, 2000
⁵ What a Waste: Solid Waste Management in Asia, May 1999

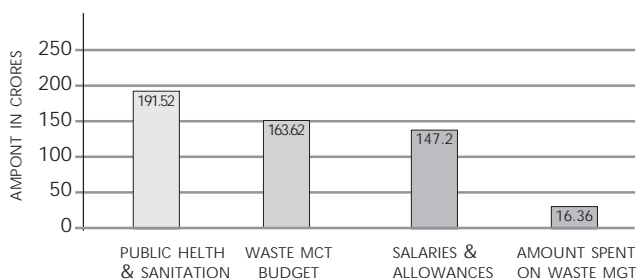
⁶ Manual on Municipal Solid Waste Management 1st ed.). Prepared by the Expert Committee constituted by the Ministry of Urban Development, The government of India, January 2000

and improvement of public health, but also has immense potential for resource recovery.

Urban Indians use twice as many resources per capita than those living in rural areas and 300 million of them generate an estimated 100,000 tonne of waste every day.^{7,8}

Though services like public health, sanitation and solid waste management absorb a substantial portion of the budget allocation of municipalities, the allocation in most cases is insufficient to keep the cities clean. This is mainly due the high expenditure on maintaining a large workforce. MCD for instance, in 1998-99, had an expenditure of approximately Rs 1,254.21 crore. About 15 per cent of this (Rs 191.52 crore) was spent on Public health and Sanitation. Out of this, Rs 191.52 crore, Rs 163.62 crore was spent on conservancy, street cleaning, scavenging drains. Of this Rs 163.62 crore, 90 per cent was spent on establishment expenses like salary and other allowances to

Waste related expenditure of MCD 1998-99



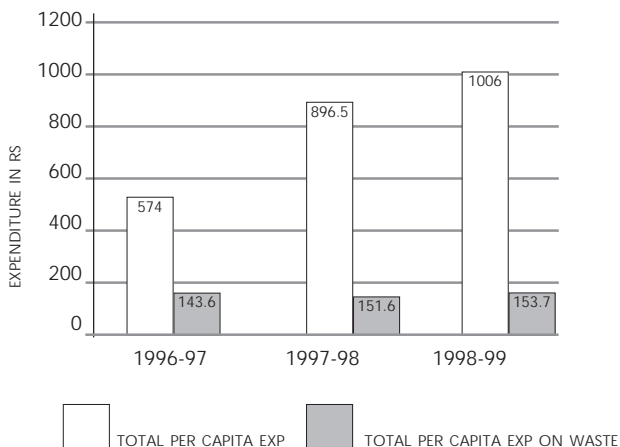
its employees.⁹ This leaves the municipality with just Rs 16.36 crore.

Out of this expenditure, on scavenging and sanitation, only a negligible proportion comes in the form of income. There is no scavenging or sanitation tax, or any contribution from the government. The only source of income is fees and fines from the violation of rules. In 1998-99, the MCD earned an income of just Rs 85 lakh (0.55% of its total budget).

Though the MCD's per capita spending increased by 42 per cent from 1996-97 to 1998-99, the per capita spending on waste increased by just about 7 per cent.¹⁰

We all know that Delhi is a reasonably filthy city. Our municipal corporation may be short of money to take care

Per capita expenditure by MCD



of waste but it has certain other qualities that are inherent to it that contribute their bit to our waste management.

A 'Bin Bin' situation

■ The Municipal Corporation of Delhi has 798 dallows, 1,428 bins and 176 open sites for garbage collection. These dumpsites are located on a system of delineation of beats based on whims and fancies of assistant sanitary inspectors. Most of these collection spots are inconveniently located. Is it not common to come across a bin often at an intersection of a busy road, near or inside a park, in market places or even in office complexes? Such siting without giving even little thought or imagination to the plan, is a nuisance for most of us. It not only is unpleasant to our eyes and nose, but also is a traffic and health hazard. When trucks come to pick up the garbage (mostly during busy hours), they occupy a major portion of the road causing traffic jams. Garbage spills out inviting dogs, pigs, insects, etc, thus increasing the risks of vector-borne diseases and infections to our health. Moreover, the design of the dallows is faulty as they are unsuitable for mechanical cleaning. The dallows are mostly cleaned manually by municipal workers who are not given any protective gear. This increases the risk to their health and safety.

■ CSE – the Conservancy and Sanitation Engineering department of the MCD has more than 38,000 safai karamcharis - people involved directly with cleaning. Then there are supervisory staff, drivers, sanitary inspectors, sanitary superintendents, etc. For every 1,000 Delhiites, there are about 3.3 safai karamcharis, which is close to the WHO (World Health organization) norm of 2/3 cleaning staff for every 1,000 persons. However, when it comes to the zonal

20 ⁷ibid (note 5)
⁸ Manual of Municipal Solid Waste Management (1st ed.), prepared by the expert Committee constituted by the Ministry of urban development, The Government of India, January 2000

⁹Solid Waste Management in Delhi. An Exploratory Study on Local Government - Community Interface. Institute of Social Sciences, New Delhi, 2000

¹⁰ibid (note 9)

level, the distribution of safai karamcharis is arbitrary. The MCD has divided Delhi into 12 zones without any basis on either area or population. Narela zone has population of about 3.5 lakh (the lowest in Delhi) has 4 safai karamcharis for every 1,000 residents. On the other hand, more than 13 lakh residents of Shahdara (north Delhi) – the largest zone – have to contend with 2.8 safai karamcharis for every 1,000 citizens. Many areas like Sadar Paharganj, Rohini and Najafgarh too, have disproportionate number of safai karamcharis.

Absenteeism among the municipal cleaners is more of a norm than a practice with MCD.



Forty per cent of them never come to work but continue to draw salaries. Moreover, there is no formal system or any office space where the cleaning staff can report. They do not even have separate place to keep their equipment

- The MCD has a fleet of more than 800 garbage trucks to transport our waste from collection sites to disposal sites. But the fleet utilisation is just 75 per cent due to poor maintenance and use of age-old vehicles. There is always a shortage of vehicles and as a result, in some zones each truck has to make a number of trips to clear the garbage.

Even with limited number of vehicles at its disposal, the fleet is mismanaged. The ASI (Assistant Sanitary Inspector) very often, assigns these vehicles the task of garbage collection and route it has to take on the basis of



¹¹ibid (note 9)

ill-informed need perception and the convenience of the staff. This further brings down the productivity as vehicles operate effectively for only two to three hours per shift due to distance and time wasted in moving from workshops to different zones.

- Garbage processing, that reduces garbage to be disposed off in landfills, has never been a priority with the MCD. Though it has taken initiatives, it now operates two waste composting plants at Okhla and Bhalaswa to convert organic waste into manure. The plant does not function to its full capacity. A proposal by a private firm to double the capacity of the plant is yet to be approved by the MCD. Another plant at Bhalaswa converts 500 tonne of garbage to manure every day. The NDMC also operates a similar plant to produce manure in Okhla.

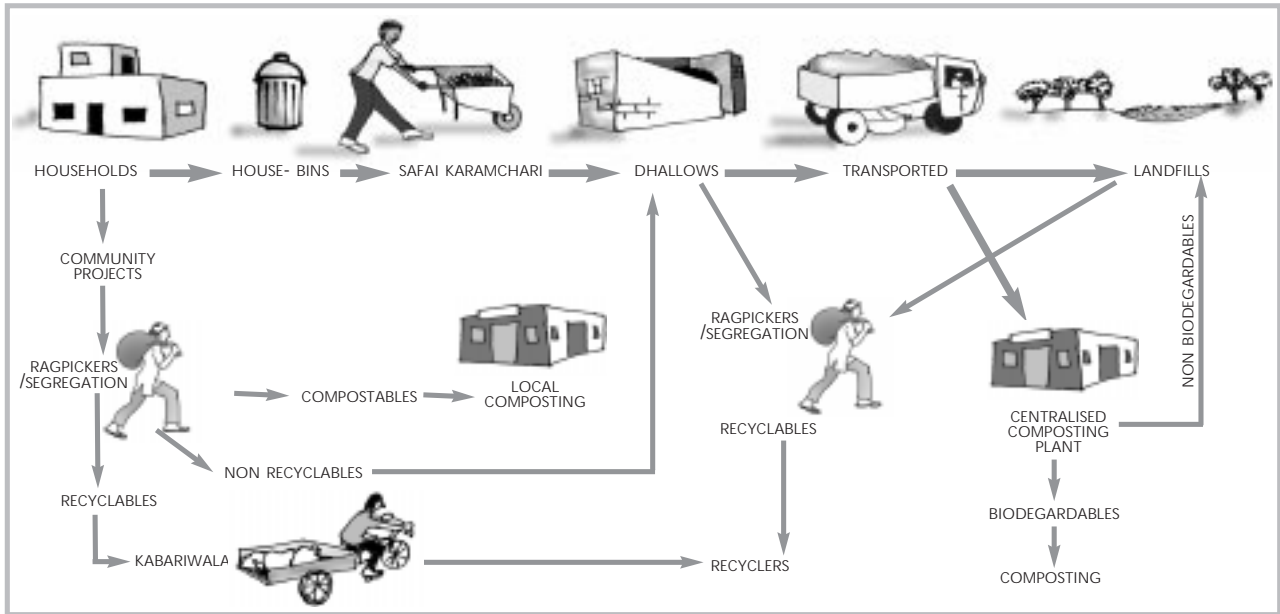
- Government departments do not always work together. A scheme initiated by the horticulture department for vermicomposting at Gazipur landfill is waiting for MCD approval.

- The present system of garbage disposal in sanitary landfills or SLFs is primitive and environmentally unfriendly. The first SLF was established in 1975, since then 15 SLFs have been used and closed in Delhi. There is no long-term plan of utilisation of the SLF sites and they continue to function on an ad- hoc basis.¹¹

In this section we have shared with you the ills that plague our municipality in managing waste. We have loaded you with lots of facts and figures. However, an effective and holistic management system also involves other issues like recycling, waste reduction, consumption habits, etc. In the coming sections we shall be looking at those issues.



Waste at a Glance



REDUCING WASTE

In the preceding sections, we have shared ideas and information on how waste generated, is a problem for us, the difficulties in disposing waste, the money required for waste management, etc. As waste generation is a reality and is an inevitably burgeoning problem, it is important that we should try to handle it and manage it more sustainably. It will help immensely if one remembers that waste represents a natural resource, and by keeping waste minimisation central to our waste management philosophy, we also save



scarce resources. So let us start with the premise that waste reduction or waste minimisation

is key to any successful waste management programme. The 3 R's - Reduce, Reuse and Recycle, are closely interlinked and interconnected, and are not independent of each other.

Reduction

As our cities and towns expand, space becomes a constraint. In such situations where land becomes a scarce resource, it seems unfair that we devote huge amounts of space to something that is of little use to us, like landfills, incinerators and garbage dumps. Disposed off garbage does not any way enhance our quality of life, nor does its generation.

Waste reduction effectively eliminates waste and prevents it from entering the waste stream. This helps in reducing the quantity of the waste generated and the related handling costs. Waste reduction also means purchase or production of materials that are recyclable or compostable. To begin with, as individuals we can assess the kinds of products we purchase and try to eliminate products that use excessive packaging or cannot be recycled, reused or composted.

Not only the consumer, but the manufacturing industry too can play an important role in waste reduction. Manufacturing and designing products that require minimum packaging or packaging that can be recycled, or altogether eliminating the need for packaging, can all contribute to effective waste reduction. Industries can also design products that have a longer life span and are easier to repair, e.g., consumer durables like toasters, blenders, electric irons, radios etc. If industries actively pursue waste reduction, the responsibility of waste reduction is shared between the consumer and the producer. Consumers purchasing goods from such producers will be aiding in the further development of products that contributes to waste reduction.

Exploring Environment Issues: Municipal Solid Waste, Project Learning Tree, Washington DC)

All wrapped up!

There are few who would not like buying things that come packed in brightly coloured boxes and packs? Packaging has evolved overtime in a significant manner to meet the needs of consumers and manufacturers and has also significantly contributed to waste generation.



Why pack

- Packaging holds items together in the size or quantity desired for purchase
- Packaging helps in protection, preservation and easy distribution of different products
- Packaging prevents tampering and provides information about the product besides giving advertising space to the manufacturer.¹

Most often, the sole purpose of packaging is to enhance a product's attractiveness or prominence on the store shelf. Packaging accounts for a large volume of the trash we generate and so on the flip side, it provides us with a good opportunity for reducing waste.

¹ Exploring Environment Issues: Municipal Solid Waste, Project Learning Tree, Washington DC)



What can we do!

- If you have a choice between two similar products, e.g., toothbrush, buy the one that has the least amount of packaging.
- Purchase items that can be reused, e.g., rechargeable batteries.
- Purchase food and household items in bulk, e.g., economy-sized items for household products that are used frequently, like laundry soap, shampoo, etc.
- Repair old cloths, appliances, furniture, etc., instead of discarding them.

Reuse

Reusing is essentially the use of a product more than once in its original form, for the same purpose or for a different one. Reusing products instead of discarding them after single use can significantly contribute to waste reduction. Reusable products certainly help generate less waste. Besides, reusing helps in reducing the cost of managing solid waste that in turn helps in the conservation of natural resources. If we just care to look around, we will find that there are many items that can be used more than once. Reusing products in fact extends their lives, keeping them out of the solid waste stream.



What we can do

- Reuse cloth napkins, sponges, and dusters by washing them.
- Purchase items in refillable containers. For instance, some containers for beverages and detergents are nowadays made to be refilled and reused, either by the consumer or the manufacturer.
- Reuse bags, containers, and other such items. If it is practical, keep a supply of bags on hand for shopping or carry a jute or cloth bag every time you go to the market. If a reusable bag is not available and only one or two items are being purchased at a time, reflect whether you need a bag at all.



- Reuse scrap paper and envelopes. Use both sides of a piece of paper for writing notes before recycling it.
- Wash and reuse empty glass and plastic jars and containers that otherwise get thrown out. These containers can be used to store buttons, nails, or used as flowerpots, etc.
- *Do not reuse containers that originally held products like motor oil or pesticides. These containers and their potentially harmful residues should be discarded as soon as they are empty.*



Recycling

Recycling is a resource recovery method involving separating, collecting, processing, marketing, and using a material that would have been normally thrown away. Recycled materials may be used in manufacturing of the same type of product or a new one. Recycling also limits the amount of waste that would either be landfilled or incinerated. Recycling of different materials like aluminium, plastic, paper, glass, etc., and also of kitchen waste (composting), helps to extend the value and utility of an item that would have otherwise been disposed off after single use.^{2,3,4}

Why recycle

All our needs are ultimately derived from finite natural resources - plastics from oil, metals from ores, glass from sand, etc. As our consumption pattern increases, so does the stress on natural resources. Reprocessing used materials to make new products lessens this stress. For example, every tonne of recycled steel saves more than 5,000 kg of iron ore and 2,000 kg of coal. Recycling used aluminium cans requires only about 5% of the energy needed to produce aluminium from bauxite. Proper recycling also reduces pollution risks by keeping materials out of disposal facilities. No matter how strong the environmental standards may be in a country, there is always some risk associated with waste disposal.

However, for recycling to be effective, there must exist a market for recyclable materials - items that are used most by people, like paper, glass, plastic and aluminium. Recycling to us is not entirely a new concept. Most of us in India have practised recycling. We sell our newspapers, old bottles and cans to a *kabariwala* (scrap dealer), give away

2 ibid (note 1)
 3 www.epa.gov
 4 www.dep.state.pa.us

the clothes that we have outgrown, and reuse glass bottles in kitchens.



What we can do

- Consider products made of materials that are collected for recycling locally. In many communities, this includes glass, aluminium, steel, paper and cardboard, and some varieties of plastics.
- Look for items in packages and containers made of recycled materials. Many bottles, cans, paper wrappings, bags, food boxes, and other cartons and packages are made from recycled materials.
- Use products with recycled content whenever you can. For instance, many paper, glass, metal, and plastic products contain recovered materials. Some examples are stationery, wrapping paper, computer paper, and containers.^{5,6,7}

We can further help in waste reduction process by managing our household waste.

The first step towards managing waste is proper segregation. Our household waste is heterogeneous in nature. Broadly it may be classified as: Biodegradable waste can be composted and thus made to contribute to waste reduction. For effective waste reduction, we need to separate our wastes in two separate

Biodegradables	Recyclables
KITCHEN WASTE – FRUIT AND VEGETABLE PEELS, LEFT OVER FOOD, EGG SHELLS, TEA BAGS, PLANT TRIMMINGS, LEAF LITTER, ETC.	DRY WASTE – PLASTIC JARS, BOTTLES, FOOD CONTAINERS, GLASS ITEMS, PAPER, CARDBOARD, CLOTH RAGS, ETC.

containers. One for biodegradables, and the other for recyclables. Segregation of waste prevents waste from getting mixed up and helps in proper composting or recycling.

Composting – How degrading!

Composting is nature's own recycling program! In forests and meadows, tree leaves and other organic materials form a carpet over the soil surface. In time, naturally occurring organisms break down or decompose this layer. The rich, dark, crumbly material that results is compost, which in essence, is nature's own nutrient-rich

slow-release fertiliser.

You can compost kitchen wastes, leaves, grass clippings and garden plants. Composting helps utilise the garbage that otherwise forms stinking heaps on roadsides or is wasted in landfills. It can be done by adopting three methods, viz., aerobic - in presence of air, anaerobic - in absence of air, and vermicomposting - with the help of earthworms.

Aerobic compost

A minimum of two pits (6'x3'x3') are required for the purpose. The number and size depends upon the quantity of garbage generated, where one pit can accommodate approximately 700 Kg of waste. Segregated kitchen waste is put in one of the pits. Once a week some leaf litter, water and soil are added to the garbage and the mixture turned. The moisture content is to be maintained at 60-70% of the total quantity. Once the pit is filled water is added and the contents turned every three days.

The compost is ready within 2-3 months when it starts resembling dark brown soil. It is kept in open air and the previous step is repeated till a homogenous colour is obtained. Then it is sun dried and sieved. The granules are put back in the pit to hasten the process of decomposition and the manure can be used for plants. Those living in the apartments can compost the wet waste in the earthen pots or containers.⁸

Vermicomposting

Composting can be done either in pits, concrete tanks, well rings or in wooden or plastic crates, appropriate to the given situation.

It is preferable to select a composting site under shade, in the upland or an elevated level, to prevent water stagnation in the pits during the rains. Regions with rainfall may better



avoid pits. In places where rainfall is confined only to a few days in a year, flooding pits by rains does not harm as

⁵ ibid (note 1)
⁶ ibid (note 3)

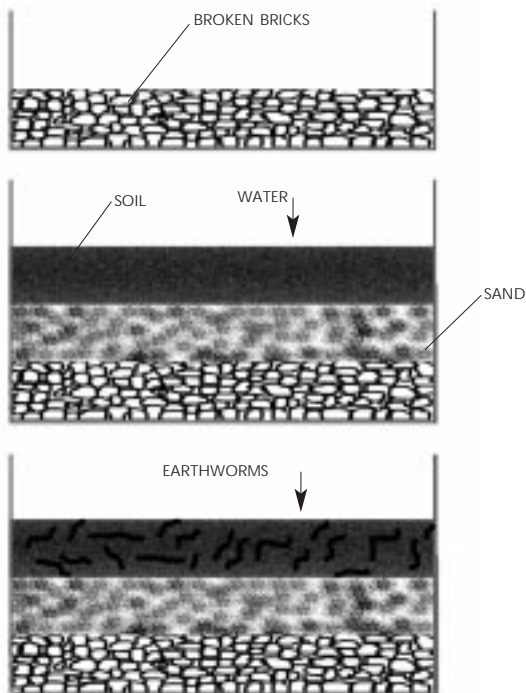
⁷ ibid (note 4)
⁸ Centre for Environment Education, South.

local varieties of earthworm's return when conditions turn normal.

Vermicomposting is set up by first placing a basal layer of vermibed comprising of broken bricks or pebbles (3-4 cm) followed by a layer of coarse sand to a total thickness of 6-7 cm to ensure proper drainage. This is followed by a 15 cm thick moist layer of loamy soil. Into this soil are inoculated about 100 locally collected earthworms (about 50 surface and 50 subsurface varieties).

Small lumps of catteldung (fresh or dry) are then scattered over soil and covered with a 10 cm thick layer of hay. Water is sprayed till the entire set up is moist but not wet. Less water kills the worms and too much chase them away. The unit is kept covered with broad leaves like those of coconut or Palmyra. Old jute bags can also be used. Watering the unit is continued and the unit is monitored for 30 days. The appearance of juvenile earthworms by this time is a healthy sign.

Organic refuse is added from the 31st day as a spread on the bed after removing the fronds. The spread should not exceed 5 cm in thickness at each application.

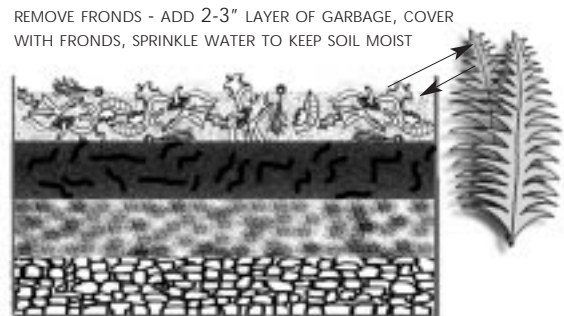


Though addition of this amount of water can be done everyday, it is advisable to spread only twice a week, watering to requirement. After a few applications the refuse is turned over without disturbing the bed. The day enough refuse has been added into the unit, just keep watering and turning over, and 45 days later the compost will be ready for harvest.

As the organic refuse changes into soft, spongy sweet smelling dark brown compost, stop adding water (42nd day). This moves the worms into the vermibed. Harvest the compost in the form of a cone on a soil ground in bright sunlight. This will facilitate whatever worms present in the compost to move to the lower layers. Spread the compost pile after about 24 to 36 hours, recover the worms from the lower layers of the compost through a 2 mm or 2.5 mm sieve, if necessary, and pack in polythene bags to retain moisture.

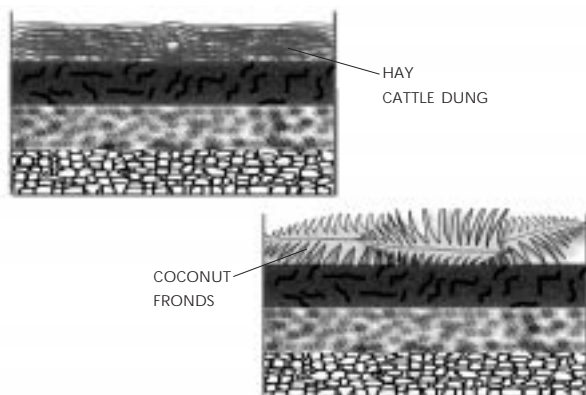
Composting in bulk

When large quantities of waste like agro wastes and municipal solid wastes are available, then it is advisable to first predigest the waste before transferring it to vermicomposting units. For predigesting either one can apply dilute



cattle dung slurry on the garbage, mix it well, moisten it to 50%-60% with water and leave it for 15-20 days on the ground as a heap or a windrow with frequent turnovers, adding water if required. The temperature of these heaps rises to about 60°C. This is advantageous in two ways as it can destroy pathogens as well as any live seeds of weeds in the waste.

An alternative to this is biodung composting which recommends placing garbage layer by layer with dilute cattle dung slurry sprayed in between the layers. The



presence of green material in the form of eaves enhances the temperature. This unit is set up on a network of poles and twigs to permit aeration from the base. The heap is not recommended to be greater than 1.5 m in width and 1.5 m in height. Length can be of any convenient dimension. The entire unit can be covered with black polythene to accelerate the process of decomposition. After 20 to 25 days with two or three turnings the material looks like dung and can be used after cooling introduced for vermicomposting.⁹

Making an informed choice

As we have learnt so far, there are a number of ways where we as consumers and responsible citizens can contribute to waste reduction. We as responsible citizens need to be aware that every material used to make a product comes from either renewable or non-renewable resource. Renewable resources like trees for making paper can be replenished through natural process. Non-renewable resources like oil, steel, coal and aluminium used to manufacture numerous items of daily use, can never be replaced once they are exhausted. All our energy needs are primarily derived from non-renewable resources. Coal for power plants, fuel for trains, trucks and buses - all come from non-renewable resources. Energy sources like sun, wind, etc., though unlimited and renewable, have not really been used to the maximum, as means to use them efficiently are yet to be developed.

Energy is used at every stage to produce an item. The earthmoving equipment that is used to mine iron ore uses energy in the form of diesel fuel. The process of transporting ore to steel plant by trains or trucks uses diesel fuel or electricity. Converting ore into finished metal and then combining it with other raw material uses more energy by burning coal etc. Producing the product, packaging it, and transporting it to consumers requires more energy and hence more use of non-renewable resources like coal, oil, gas, etc. Disposing of the used product or recycling it if possible, completes the resource and energy cycles, but does not return to nature hundred percent of either the resource or the energy already consumed.

The choice to use renewable or non-renewable resources for our needs has a global impact. Recycling whenever possible and developing more efficient ways to recycle will help in extending the availability of non-renewable resources. Whenever we use products like jute sacks or cotton garments and fuel (source of energy) like wood derived from renewable sources, we need to manage them sustainably.¹⁰

Hence, it is for us to make informed choices on the way we consume and what we consume to ensure sustainability of resources and work towards minimising waste generation.



⁹ Vermitech by Sultan Ismail
¹⁰ Ibid (note1)

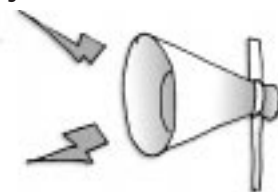
MAKING A DIFFERENCE: Community Projects



As we learnt in the preceding pages, managing municipal waste is a complex issue. It is subject to various factors. As waste becomes more visible around us, managing it becomes more and more difficult although citizens are becoming increasingly concerned about the waste they generate and the ways to manage it effectively. It is now becoming clear that only centralised systems of waste management are not enough to control waste. Experience over past few years has shown that community-led initiatives help decentralise waste management, and make it sustainable at local levels.

What is a community project?

Any work done by or along with a community ensures better standards, for its members constitute the realm of community project.



Thus if the goal is that of setting up a better waste management system the community, after identifying the problem, would help evolve a system that is best suited to its needs. The end result ideally should be a system that is not dependent or least dependent on the municipality or any other official body. However, there needs to be an interface between the community project and the local municipality. It also means that the people within the community are responsible and have a better understanding of the problems and related issues. Such community waste management systems can be a model for environmental-friendly waste management initiatives.

Community waste management the easy way out?

All community waste management projects need an active support and participation of the various stakeholders. Residents need to participate and contribute financially through regular subscription to sustain the effort and make it financially viable. Subscriptions help ensure regular payment of salaries, uniform, etc to people involved in waste collection who ideally should be rag pickers for disposal process and maintenance of equipment. Sale of compost and recyclable material can only supplement the funds needed for such an effort. There has to be a sense of ownership among the residents to maintain and sustain the waste management effort and hence proper collection and segregation of waste needs to be supervised from someone within the community. NGOs may only intervene in the initial stage to help set up the system but they cannot sustain the effort from outside in the long run.

Involving the local municipality is also very essential as it



gives legitimacy to the effort. Besides, the municipality's participation is essential in this venture say, to earmark land for composting, identify a place for segregation and sorting of waste. Community waste management not only reduces the dependency on municipalities to manage waste, but such initiatives also serve as vehicles to sensitise the people about their own environment and encourage them to take action to improve it through self-help efforts.

Why is it necessary?

Localities within a city are not provided with the same level of municipal service. It is often related to the socio-economic status of the people residing in an area. For e.g., in Delhi, people living in areas like Jor Bagh or Chanakya Puri have far better waste management systems than in areas like Jehangirpuri or Seelampur.

Another important feature of such projects is that it helps in empowering the community to solve their problems within the community rather than being dependant on any external agency. These projects make inroads into the community to further involve them in environmental issues.

A major benefit of a community-based waste management project is that the waste does not leave the community, but the latter finds a way to reduce and/or convert the waste into something useful. In this way the community becomes more responsible and conscious of their waste generation.

The municipality, which complains of being overburdened, may also thereby be able to re-allocate its resources for other public works like water supply, electricity, etc.

Let us now look at some waste management efforts that are initiated by people living in communities.

Advanced Locality Management Community–Corporation Partnership, Mumbai

Sprawling concrete jungle, lack of green space, pollution and garbage-strewn streets - that's Mumbai city for most of us. In such a city where people are always in a hurry and hard-pressed for time, community participation to address the problem of waste sounds a little farfetched or almost like a dream. However, if pursued hard, dreams too turn into reality. And that's exactly what's been happening in this city.

It all started in 1996 in Joshi lane in Ghatkopar. The immediate cause was the civic state of the area, unofficially called *kachra gali* (garbage lane). Children of the area were falling sick all the time. In desperation, Viren Merchant, a local resident, decided to do something about the state of the area. When he complained to the municipal authorities, they pleaded their inability to solve the issue. While the municipality had only four people to clean up the road, over 400 people contributed to the litter in Joshi lane. But eventually, Merchant succeeded in getting an assurance from the Municipal Corporation of Greater Mumbai (MCGM) to clean up the area provided he mobilised the citizens to recognize the problem and help maintain cleanliness of the area.

Merchant organised the people of the area into what he called an ALM or Advanced Locality Management. The participants decided to segregate their waste by putting the organic waste into a specific community bin provided by the MCGM, while the dry waste was handed over to the *jamadar* (waste collector). This slowly led to exploring options for discarding all organic waste, which finally led the citizens to have a vermicompost pit. The compost was



used for plant beds designed to beautify the area. Today, the locality that was once known as *kachra gali*, does not even have a community

bin in the locality! It has actually realised its dream of achieving a 'zero waste' situation.

Success of this pilot project led the MCGM to formulate an ALM policy, officially recognising all ALMs in the city. Today, there are in all 643 ALMs along with 276 vermicompost pits spread over six zones of the MCGM's jurisdiction. This way approximately 20 to 25 tonne garbage per day is prevented from reaching the dump yards. An encouraging fact is that women run 80% of these ALMs. The MCGM has also established three vermicompost projects on its own, one each in the eastern and western suburbs respectively, to demonstrate to the citizens, the benefits of vermiculture technology.

The ALM concept is not restricted to residential areas alone. It is also being extended to slums and commercial areas. In Mumbai, the first ALM run by a commercial organisation began functioning in 1999. The concept was also established in about 45 slum areas where the community has come together to form such societies and has taken up house-to-house collection of garbage, thus improving the level of cleanliness in those areas.

According to S S Bhagwat, Officer on Special Duty for the ALM, the success of any ALM depends entirely upon people's participation. Viren Merchant, one of the pioneers behind the ALMs, adds to this the importance of street funding for the successful implementation of the programme. One of the basic arguments against an ALM is the lack of availability of space in big cities like Mumbai for composting. However, according to Merchant, this is a minor problem as roadside pits, hanging pots, etc. would be sufficient to help achieve direct composting in them.

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Exnora International Chennai

Exnora is a Chennai-based organisation working since 1989 in the field of solid waste management. Through their innovative programmes called Civic Exnora, Street Exnora and Home Exnora, they have brought about a change in the waste management philosophy. Their programmes have been replicated in Bangalore, Vadodara, Madurai and Vijaywada. Today it has around 5,000 branches and hopes to expand more.

Exnora has successfully adopted the system of house-to-house collection of garbage. They have trained rag pickers, calling them street beautifiers, providing them with specially designed tricycles sponsored by private companies in the locality. The street beautifiers collect garbage from door to door and transport it to the secondary collection pits/transfer stations. They work from morning, starting with garbage collection and then sweeping the streets everyday. An average fee of Rs 10 per month is collected from the residents although the fee may vary from area to area.

Initially through an awareness drive, residents of an area were explained the importance of keeping the wet and the dry waste separately and were provided with two bins, one green and one red, for the collection of wet and dry waste respectively. The wet waste is composted while the dry waste is sold by the street beautifiers at the recycling market. They have also come up with innovative methods like providing residents with *Parivardhan*, a drum with holes. This perforated drum is used in households for aerobic composting of the waste. At places, vermicomposting is also done. For example, in the Chromepet area, which covers around 250 houses, aerobic and vermicomposting methods are used for organic waste disposal, while in the Lake area in Nungambakkam, with approximately 600 households, aerobic composting is done for the wet waste.

Exnora believes its programme has been successful due to:

- decentralised waste management
- reducing waste at source
- meaningful community participation

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**Vatavaran
 a success story at
 Jawaharlal Nehru University,
 New Delhi**

Vatavaran, a New Delhi-based NGO is working on an innovative garbage management project named Cleaning Brigade Scheme. Till 1999, Vatavaran served almost 10 lakh people in 29 residential colonies in Delhi under this project. The whole garbage management operation is in three stages - collection, segregation and composting.

One of Vatavaran's most successful projects has been at the Jawaharlal Nehru University (JNU) campus.

The project was started in April 1995 and has been running successfully for the past six years. The JNU campus spreads over 1,000 acre of land. It consists of 15,000 people with 950 households in different residential units, students' hostels, administrative blocks, health centres, shopping complexes, cafeterias, roadside eateries and others, which generate around 2,000-2,800 kg of garbage every day. Of this 48% is recyclable. The 'cleaning brigade' in JNU comprises of 29 boys, six deputy supervisors and one field supervisor. The University authorities have donated a large tract of land to Vatavaran for composting waste. A biogas plant had also been installed with the help of the Tata Energy Research Institute (TERI), which for some reason has now stopped functioning.



JNU Project at a Glance	
Waste	2,000 Kg/day
Household (no.)	3,000
Cleaning brigade (includes supervisor, deputy supervisor and cleaning boys)	1+6+29
Monthly fees	Rs 44,000
Monthly pay (a) supervisor	Rs 3,000
(b) boys	Rs 2,100
(c) deputy supervisor	Rs 1,800
Expenditure monthly (minimum)	Rs 52,000

The money required to run the project has to come from the client groups themselves. The University pays a consolidated sum every month to Vatavaran as a running cost that is partially retrieved by the University from the residents from their monthly salaries with the rates varying proportionately vis-à-vis the incomes of different sections of the employees. The cycle vans for garbage collection and the dresses and boots for the cleaning boys has been provided by HUDCO (Housing and Urban Development corporation Ltd).

The 'cleaning brigade' earns more than Rs. 10,000 a month by selling the recyclable material from the refuse they collect. A small amount is also earned from the sale of manure from the compost pits. Although the price for compost is very low (Rs 2/kg) it is usually

not sold for money but is bartered against other reusable garbage from households that again is sold to kabariwalas (scrap dealers). In fact, JNU has recently granted the contract for maintaining all gardens in the campus to Vatavaran. A large number of gardeners known as "green brigades" have also joined the Vatavaran team.

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ACORD

New Delhi

Set up in 1981, ACORD (Asian Centre for Organisation Research and Development) has been doing innovative work in the field of solid waste management in Delhi.

ACORD'S very first initiative was a pilot project in Harkesh Nagar, a low-income colony in Delhi. The nature of intervention was largely action-oriented. The project involved awareness building and operation of a waste collection system through distributing demonstration kits for segregation of waste and processing of waste as compost. While composting activity has been disrupted as the land has been taken away by the Delhi Development Authority (DDA), door-to-door collection of waste continues in several locations within the community.

Based on the success of the experiment in the pilot project, the ACORD initiated collective composting in Bharatpur, at a village level involving groups of 15-20 farmers per village. Through consultations, farmers of the village decided about the quantum of waste that would go in from each household - mainly comprising of cattle waste, household waste



and agricultural waste. The compost made out of the waste would then be equally distributed among the farmers. Subsequently now, the farmers have started individual composting.

ACORD is now implementing a large-scale project in Delhi - "Upgrading Environment Quality of Delhi" - which is being implemented at the Central Zone of the Municipal Corporation of Delhi (MCD) and in circle III of the New Delhi Municipal Corporation (NDMC).

The project focuses on awareness building, public participation and facilitating primary collection of waste.

No. of areas covered by this project

Markets and institutional areas	21
Authorised colonies	95
Unauthorised colonies	50
Slums	34

A combination of communicative media through electronic, print and traditional methods are used as outreach to the masses, which includes two telefilms, four tele-spots (advertisements), a Website (www.swachdelhi.com), summer camps for school children, teachers and sanitary workers.

One of their recent endeavors have been the community-based action plan for effective solid waste management in Kuppam in Andhra Pradesh. Here, ACORD tried to build the institutional capacity of the Kuppam Town Panchayat (KTP) in solid waste management.

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Zabbaleen Environment and Development Programme Cairo, Egypt

Cairo's 1.5-crore inhabitants generate more than 6,000 tonne waste per day. The local municipal corporation along with people from ethnic communities like the 'Wahis' and the 'Zabbaleen' help manage it. The Wahis and Zabbaleen are responsible for actual waste collection in the city of Cairo. Zabbaleens collect the waste and take it to their settlement for sorting and recycling. To ensure survival of the Zabbaleens as effective service providers to manage waste, and improve their living conditions, the Zabbaleen Environmental and Development Programme was initiated in 1980s. The Egyptian government, the World Bank and the Environment Quality International, jointly implemented the project. Intervention activities were targeted at improving environmental and living conditions, promoting enterprise among community residents, especially women, increasing the service capacity of the Zabbaleen, and instituting low-cost technological innovations. The programme is also aimed at putting an end to child labour.

The project was designed to provide the Zabbaleen of

Cairo with new business opportunities related to their trade. Community-based recycling units and a 160-tonne per day composting plant was set up to convert animal manure and other organic waste into compost. The operation and maintenance cost of the plant was recovered through the sale of compost. To institutionalise the waste collecting system of the Zabbaleens, more than 50 private companies of Wahis and Zabbaleens have been organised.

Further, the project helps provide sanitation services to low-income areas of the city for which the community paid the Zabbaleen for the services rendered.

This programme is cited as an example of existing natural and human systems that provide solutions to urban problems like waste management. It demonstrates how a low-income group that otherwise would have been treated as an economic burden of the society, can be gainfully employed in a productive urban service. The project has enabled thousands of individuals to access cheap and renewable source of raw material from waste, simultaneously providing essential products in the market at low prices. It has protected the environment from annual accumulation of several thousand tonnes of waste and reduced the need for importing high-cost and energy-intensive equipment.

The programme has also helped address human development. It has provided the Zabbaleen community with security, dignity and confidence in being able to help themselves and sustain their economic and social gains. Household income of the Zabbaleens increased because of this programme. Also social scourge like child labour declined as a result of the introduction of motor vehicles in place of donkey carts for waste collection. Additional jobs have been created with the introduction of cottage industries in the community and the expansion of the Zabbaleens' services citywide.¹

Srishti New Delhi

Srishti, a Delhi-based NGO, works as a facilitator in setting up community organisations in low and middle-income localities for managing solid waste services. Srishti's objectives are to initiate solid waste management project in certain localities, manage the pro-

gramme for certain periods of time, build community organisations and train them to take over and run the programme on a financially viable basis and then withdraw from the project. The intervention by Srishti has ranged from biomethanisation project in resettlement colonies to garbage management through rag pickers and composting.²

Biomethanation

Dakshin Puri is a rehabilitation area of New Delhi where civic amenities related to sanitation and wastes are inadequate.

Biomethanation technology is based on the gohar (cow dung) gas system. However, instead of cow dung, biodegradable kitchen waste is fed on a daily basis. During the process of feeding, an equal volume of slurry from the digester flows out which is known as volume displacement. This slurry makes very good manure. Initially, however, the biodigester has to be fed with fresh cow dung. Also with the degradation of the waste, methane gas is formed, which is trapped in the dome of the system. This gas can be used as a cooking fuel.

Srishti, along with the TERI, carried out a waste survey to determine the nature and quantity of waste. Spaces for setting up the digester was provided by the MCD and the personnel to manage it were two local rag pickers. The ragpicker collects waste from the bin, sorts it and feeds it in the reactor. For this work he is paid a sum of Rs 800 while the resident in charge gets a regular supply of methane gas.

Ragpickers' group at the Indian Agricultural Research Institute (IARI) – Pusa Road, New Delhi

At IARI, after an initial waste survey, Srishti decided to have two different types of collection systems - door-to-door and from waste bins. The idea behind the latter was to have drums located at fixed positions to cater to a certain number of institutions and hostels. Thus it was decided that all multi-storied apartments and offices would have drums.

The next step was to evolve routes that would reduce time for collection and not be too far from the disposal and composting site. Cycle carts or wheelbarrows were used although their use depended on the distance that had to be

¹ CAPE, 1993 Pg 77-78, The Wealth of Waste, Sandhya Venkateshwaran, Friedrich Ebert Stiftung)

² Solid Waste Management in Delhi, An Exploratory Study, on Local Government - Community Interface, Institute of Social Sciences, New Delhi, 2000

covered. Pit composting was used as a method to reduce the quantity of biodegradable waste.

Six rag pickers were identified and trained. Srishti, along with the IARI administration, sent official letters to all residents and offices explaining the concept to them and ensuring their compliance. Money to pay the rag pickers was collected from all residences by a door-to-door collection. Any short fall was made up by the IARI administration. The rag pickers' income was supplemented by the sale of recyclables collected during their work.

The rag pickers were given uniforms and identification cards. In fact, Srishti had initiated a novel step of collective responsibility among the rag pickers. One ragpicker was chosen as a supervisor. He had to see that the work is done and that all the implements are in working order. For this responsibility, the person was paid extra money.

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Why community projects fail?



1. Lack of community ownership and sustained interest

Community projects begin on an enthusiastic note with many people joining the effort. However, the enthusiasm tends to slacken over time. This happens when the intervening organisation, most often an NGO, begins the process of withdrawing and handing over the management of project to the people. At this point the community may begin to lose interest, being unable to develop a



sense of ownership of the project as it is seen as the intervening NGO's baby.

2. Lack of participation by majority of households

It is a fact that household participation that is necessary for any community project is not always forthcoming. Households tend to think that managing waste is the sole responsibility of the local municipal corporation and that their role is limited to disposing the waste in their dustbins, depositing it outside their house or giving it away to the sweeper. Segregation of waste that is essential for any successful waste management programme is also resisted by many households as it involves an extra effort in disposing waste. If adequate number of households do not participate, then the project does not remain financially sustainable.



3. Poor collection of monthly subscription

A community project requires small financial contribution by households to sustain the project. Paying money for waste disposal is something that many people do not relate to as the municipality offers this service free of charge. Collection of subscription needs to be supervised by someone from within the community and such a person may not always be available.

4. Lack of space for composting

Community waste management projects require space for onsite composting of biodegradable waste. This space may not always be available due to resistance from households who might object to compost pits being dug near their homes on pretext of stench, hygiene, etc, although properly maintained compost pits do not give out any bad odour or are unhygienic. However, in multi-storied apartment complexes there is often lack of open space like parks etc. for composting. In such places, composting may have to be carried out in big drums that again would need some space for installation that may not be easy to come by. Besides, the local municipality needs to provide space to the community for such projects.

5. Uncooperative municipality

Municipal corporations are not always helpful in sustaining community projects. Often they refuse to provide land for composting and prevent local rag pickers from collecting waste, etc.

6. Resistance by municipal sweepers and safai karamcharis (cleaners)

Municipal sweepers and safai karamcharis tend to feel threatened by a community waste project as their job of collecting waste is taken over by people working in the project. Safai karamcharis and sweepers often sell the recyclable content of the waste to earn an extra buck. In community projects, this is not possible as proceeds of sale from recyclable waste are part of the collector's (rag pickers) income and help support the project to make it sustainable. An interface between the municipal sweepers and waste collectors of the community project is required and needs to be negotiated wisely.

PLASTICS...STICKING ALONG!

About 50 years ago, the discovery of a new material transformed our lives. It is now everywhere as we use it several times a day - from morning onwards when we brush our teeth, when we go out, eat our food, work, visit a doctor or a hospital. Yes, we are talking about plastics. Much is being written about plastics these days. Over the past 50 years, this "wonder" material has penetrated almost all aspects of our life, pushing traditional substances like jute, cotton, wood, coir, paper, cardboard rubber and glass to obsolescence, so much so that it poses a serious hazard today to our environment. The moot question now is:

can we break out of this plastic mould?



Newspapers are replete with stories about the menace of plastics, about the government banning polybags around the country, about schools and colleges launching awareness drives to phase out use of plastic substances. And yet, they are still around and being strewn around

ubiquitously in the streets, in the drains and rivers while choking them, they stand out like ugly pockmarks on an unblemished skin!

What are plastics?

The word 'plastic' is derived from the Greek words 'plassein' and 'plastikos' meaning to mould or to shape a soft substance permanently or temporarily. In the late 1980s, plastics had various definitions. It was only in the early 1990s that a concrete definition of 'plastic' was coined.

Carried in the plastic industry's first trade journal 'Plastics', the definition read: "a commercial class of substances worked into shape for use by moulding or pressing when in a plastic condition."

Perils of plastics

Longevity, one of the most important properties of plastics, is also its bane. Plastics do not degrade easily and persist in the environment for a long time, slowly releasing the chemicals that they are made of into the environment. Most problematic varieties are the chlorinated plastics.

Commonly used chlorinated plastics are polyvinyl chloride or the familiar PVC, used in several articles of common use.

PVC's toxicity begins right from its manufacturing process and persists throughout its life. Firstly, the making of PVC powder involves the transport of dangerous explosive materials. Secondly, raw PVC by itself is not useful. It needs toxic chemical additives like phthalates to make it soft, heavy metals like lead, cadmium and chloro-paraffins to give it a hard texture and colour and to make it fire-resistant. All these additives are dangerous toxins and are known to leach into the environment over a period of time. US Federal Food and Drug Administration (FDA) found vinyl chloride leaching from food containers that are used for containing vinegar, apple cider, vegetable and mineral oils. Liquor bottles, earlier made out of PVC, have long been banned in the US.

In India due to lack of product labelling, it is very difficult to differentiate between different types of plastics. Municipal solid waste generated by the urban centres contains a mix of plastics that are often burnt at municipal dumpsites or roadsides, thereby releasing toxic chemicals present in the plastics. Most dangerous of these chemicals are dioxins and furans that are released when chlorinated compounds are burnt at a certain temperature. Thirty per cent of the world's chlorine is used for PVC manufacture.



Deadly Dioxin

Dioxin is an organochlorine compound known to persist in the environment for a long period of time. It is classified as one of the Persistent Organic Pollutants (POPs), a group of highly toxic compounds that have been marked for global elimination in the recently signed POPs Treaty under the UNEP. The International Agency for Research in Cancer (IARC) has classified 2,3,7,8 trichloro dibenzo-p-dioxin or TCDD (belonging to the dioxin family) to be a human carcinogen. Other health effects include reproductive and birth defects, immune and hormonal systems dysfunction.

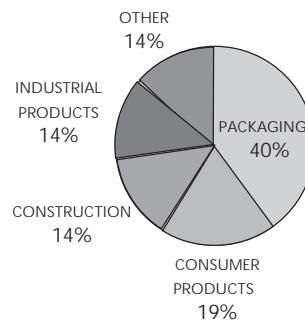
Plastics in India

India's per capita consumption of polymers (plastics) increased to 2.4 kg during 1998-99. Indian plastic industry's steady growth of 16% is fuelled by a growth in the GDP and the increasing ethylene capacity. It is estimated that India, in the near future, will be consuming 5 million tonne of plastics annually. The largest end users



of plastics are the moulded luggage industry, PVC pipes and fittings, and the packaging industry. In fact, the packaging industry is one of the single largest markets available for the plastics industry in India. According to industry estimates, "plastic has captured 40% of the total \$ 6.3 billion packaging market in India." And most of the demand for plastic packaging comes from the food processing, construction, agricultural and water management sectors. "The increasing presence of multinational consumer companies in India has boosted the packaging sector and therefore, plastics packaging sectors as well," as reported in the *Industry Sector Analysis* (1997). Due to the lack of any Extended Producer Responsibility (EPR) policy in India, like a take-back policy, where the company selling products are responsible for collecting, recycling and disposing the packaging material, as is practised in Germany and many other developed countries, our packaging material ends up in drains, rivers and land. Some of it gets recycled or down-cycled, although into some inferior products.

End use for plastic products in India (1996)



Types of plastics and their uses in India

Polypropylene (PP): The major market for PP in India is in the packing of fertilisers, powdered chemicals and cement. It is also injection-moulded into containers, house wares including crockery, schoolbags, briefcases, combs, furniture, toys, bottles, automobile components and disposable syringes. PP films are widely used for packaging of soft goods, food-stuffs and textiles, domestic appliances such as hair dryers and electronic equipment. Fisherfolk nowadays use nets made of PP. ²



Low-density polyethylene (LDPE): It is moisture-resistant and is used in damp proofing to line ponds and canals to prevent seepage. It is also used for lamination of paper, in coating milk and other food cartons and also for corrugated boxes needed for industrial purposes. LDPE pipes are used for water transportation, mainly in the electrical industry and in sewage disposal. The squeeze bottle is made by blow moulding LDPE. A refinement of LDPE is LLDPE, Linear Low Density Polyethylene that is gradually replacing the former in many applications.

High Density polyethylene (HDPE): Due to its properties such as rigidity and resistance to heat, HDPE is used in a number of household items such as buckets, cups, plates and bowls and also for packaging of foodstuff. Besides, it finds use in the making of crates, heavy goods for chemicals and ropes and nets.

¹ <http://strategis.ic.gc.ca/SSG/p101309e.html>

² CRISIL Sector brief: Polymers, November 1999

Polyvinyl chloride (PVC): It is the largest selling plastic in India capturing about 28% of the total plastics market in the country.

Engineering thermoplastics (ETPs): It often displays superior mechanical properties such as tensile and high-impact strength compared to metals. Because of the fact that they are much lighter than conventional materials having the same or better performance, they are used readily for aerospace applications, aircraft and some sectors of the transport and telecommunication industries. ETPs are used in cellular phones, CDs and CD-ROMS, optic fibre cables, satellite TV, space and defence applications as well as in automobile parts. The major four ETPs in India are: Polyamide (PA) - mainly nylons, Polycarbonate (PC), Polyacetal (POM) and Polybutylene Terphthalate (PBT).

Polystyrene: It is mainly used for packaging and encasing. The largest market segment for polystyrene is audiocassettes.



Plastic waste generation in India (in thousand tonnes)

	1995-96	2001-02	2006-07
TOTAL PLASTIC CONSUMPTION	1889	4,374	8,054
PROCESS WASTE (2%)	38	87	161
POST CONSUMER WASTE*	870 (46%)	1,966 (45%)	3,624 (45%)
WASTE AVAILABLE FOR RECYCLING	800	2,000	NA

*REPROCESSABLE MIXED PLASTIC WASTE

National Plastics Waste Management task Force, MoEF government of India 1997

In absence of any labelling system in India, segregating different types of plastics at the consumer level is very difficult. Plastic wastes constitute about one to four percent by weight of the municipal solid waste. Sixty to eighty percent of this plastic waste is collected manually for recycling by ragpickers, 'kabadiwalas' (scrap dealers) and waste dealers. Usually, 'sorters' do the segregation of plastics by physically examining them by hand.

Different types of plastics are recycled separately as they have different processing temperatures and are often incompatible with each other. It is important to note that plastics lose their original property every time they are recycled.

Most of the plastic recycling is done in the informal sector where occupational and environmental standards are lax. Though the Bureau of Indian Standards finalised the standards for plastic recycling in 1997, they are yet to be implemented.

Plastic Legislation

In 1999, the Ministry of Environment and Forests (MoEF) passed the Recycle Manufacture and Usage Rules for recycled plastics, banning any vendor from using carry bags made out of recycled plastics for carrying, dispensing or packaging of foodstuff. The Usage Rules also clearly stated that virgin or recycled plastics should be of a natural shade or white (never black) and not less than of 20 microns thickness.

A similar bill for Delhi, the Delhi Plastic (Manufacture, Sale and Usage) And Non-Biodegradable Garbage (Control) Bill, was circulated by the Delhi government in 1999, but this is yet to be passed and enacted.

Various state governments have also passed various legislation to control the uncontrollable plastics problem.

Starting with the pioneering act in Simla in Himachal Pradesh, a ban on plastic littering has been enforced in Sabarimala in Kerala, Karnataka, Rajkot in Rajasthan, Nepli and Kansal forest area in Chandigarh, Srinagar in Jammu & Kashmir, Delhi, and Goa, and more recently in Bangalore.

But is banning polybags the solution to getting rid of plastic wastes?

Banning of recycled polybags is not the answer to the plastics problem. It actually sends out a wrong signal to the recycling industry, which mostly exists in the informal sector, and encourages the plastic industry which obviously have little interest in promoting recycling and would profit from such bans. Instead of improving the existing infrastructure (albeit informal) of the recycling industry by various fiscal, technological and regulatory means, these

bans will actually push the informal recycling sector to adopt illegal means, thereby further degrading the working conditions of the workers and then, naturally, the environment. So far, plastic bans in the various states have not been much effective because loopholes in the regulations have led to the continued use of recycled polybags.

What is needed is a change in approach for dealing with the waste problem. Instead of a “product approach” like banning or restricting a product, which to a limited extent is effective, it should be “material approach” which is recycling and reuse of materials and creating incentives for initiatives taken to reduce the use of virgin materials or resources, and encouraging use of safer substitutes.

Do you know?

- Delhi is Asia's (probably the world's) largest plastic waste market in handling and trading.
- In 1998, plastic bags clogged the drains of Mumbai, causing immense water logging and inconvenience to citizens. In 1998, a landslide caused by a mountain of dumped plastic bags led to the death of 27 people in Sikkim.
- Autopsies on cows in Delhi have shown their intestines to be stuffed with 40-45 kg of plastic bags indicating a terribly painful death they suffered.
- Research by dermatologists reveal an increased incidence of leucoderma - a progressive loss of skin pigmentation - that results in white patches in women who regularly wear bindis, plastic slippers or carry plastic purses tucked inside their blouses.
- If Indians again start using traditional items like jute bags and bamboo products instead of plastic products, it will generate agricultural employment to about 50 lakh people all over India.

Srishti. Information Sheet on plastics (unpublished)

What we can do

While the government is doing its bit, we as consumers should be conscious of our actions and its impact on the environment. The following are some simple things that we can do as an informed community:

- Carry your own bags while shopping
- Refuse to accept plastic carry bags wherever possible
- Avoid flimsy and dark-coloured plastic carry bags
- Urge vendors and shopkeepers to hand out items in paper bags
- Separate dry/inorganic waste – plastic, paper, glass, etc. - from wet waste like kitchen waste, leftover food, leaves, etc.
- Do not burn plastic waste
- Refuse to buy over-packaged products
- Follow the 4 'R's – Refuse, Reduce, Reuse, and Recycle



Other References

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4. Thorpe, Beverly; PVC: Toxic waste in disguise; Greenpeace International; 1992
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MANAGING WASTE- The Legislations



By now it is clear that waste management is quite a complex issue. The government has formulated rules and regulations on this issue only when it has been pressurised about the enormity and gravity of the matter. The Ministry of Environment and Forests (MoEF) has come out with Municipal Solid Wastes (Management and Handling) Rules, 2000. These rules have guidelines

and specifications on different aspects of waste management, viz. collection, segregation, storage, transportation, processing and disposal.

Let us briefly look at the role that municipalities are supposed to play and our responsibility with respect to each of the above aspects according to the MoEF rules.

Collection

Collection is lifting of waste from different collection points like dust bins, dallows, open dumps etc. As littering is prohibited, it is the responsibility of the waste generator to ensure proper collection of garbage for disposal. Municipal authorities, on their part, have been entrusted with specific roles.

House-to-house collection of waste by providing them with



community bins or having collection vehicles visiting each house at a given time could be a useful idea. Waste must also be collected from slums, hotels, commercial complexes, etc. Burning of garbage, including leaves, has been banned by the government, and should be adhered to. Once the waste is collected it shall be taken away in containerised hand-driven carts or other small vehicles and dumped in community bins. Biodegradable waste from vegetable/fruit/fish markets and slaughterhouses shall be managed (composting, biomethanation, etc) to make effective use of such waste.

Biomedical waste shall not be mixed with municipal waste. Only treated biomedical waste, e.g. autoclaved and shredded plastic, can be handled with municipal waste.

Segregation

Segregation, as we all know, is imperative for a successful and effective waste management plan. To encourage segregation, awareness programmes among people shall be taken up by municipal bodies jointly with resident welfare associations and non-governmental organisations. People on their part will need to segregate the waste they generate and dispose them in separate coloured bins (provided by municipal bodies) - biodegradables in green, recyclables in white and other waste in black.

Storage

Bins and other storage facilities shall be provided by municipalities at places that are easily accessible to users and made in accordance with the quantity of waste being generated. Storage facilities also must be easy to clean and maintain. Manual handling of waste must be prohibited. If it is unavoidable, manual handling shall be carried out observing proper precaution with due care taken to ensure the safety of workers.

Transportation

Municipal authorities must ensure that vehicles carrying waste are properly covered so that waste is not accidentally scattered around or is exposed. All the bins and waste



storage sites shall be cleaned daily or before they start overflowing with waste.

Processing

Waste reduction not only makes waste management easier and cheaper, but it also ensures that less waste is dumped in the landfills. Municipal bodies can adopt different options to process different kinds of waste.

Biodegradable waste may be processed by taking recourse to methods like composting, vermicomposting, anaerobic digestion, etc. Recoverable resources like plastic or metal shall be recycled. Incineration may be used only in specific cases. Wastes that would need to be incinerated shall not be chemically treated with any chlorinated disinfectants. Also, chlorinated plastics shall not be incinerated.

DISPOSAL OF MUNICIPAL SOLID WASTE

Disposal is the final stage in garbage management. Most of our waste is landfilled. The MoEF rules regarding disposal state that only non-biodegradable, inert and other waste that cannot be recycled or biologically processed, shall be landfilled. To prevent pollution hazard, a landfill should have a non-permeable lining at the base and the walls of

the waste disposal area. Run-off from any landfill area should be prevented from entering a water body. Landfilling of mixed waste should be avoided unless the same is found unsuitable for waste processing. The landfill site shall be located away from habitation clusters, forest areas, water bodies, monuments, national parks, wetlands and places of importance.

The responsibility of enforcement of these rules is with the Secretary in charge of the Department of Urban Development in the concerned state or the Union Territory in metropolitan cities.

District Magistrates or Deputy Commissioners are responsible in their respective districts for enforcing solid waste management rules.



The guidelines provided by the MoEF in Municipal Waste (Management and Handling) Rules, 2000, are to be fully implemented by municipalities across the country by December 31, 2003.

SOME FURTHER READINGS AND WEBSITES

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 - 2.** Waste Prevention, Recycling, and Composting Options: Lessons from 30 Communities. US EPA February 1994
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 - 4.** The Economics of Municipal Solid Waste,David N. Beede, David E. Bloom, The World bank research observer, vol 10 no 2 (August 1995) pp 113-50
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 - 7.** Paying the Price: Plastic and Rubber Recycling A health and environmental impact case study of Baprolla village. Srishti, October 1997
 - 8.** Plastics in our lives. Vatavaran march 1996
 - 9.** Garbage to Gardens. Centre for Environmrnt Education, South
 - 10.** Lesser Plastics for a Better Future, Centre for Environmrnt Education.
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