SOLID WASTE MANAGEMENT

"Anything else you're interested in is not going to happen if you can't breathe the air and drink the water. Don't sit this one out. Do something. You are by accident of fate alive at an absolutely critical moment in the history of our planet."

- Carl Sagan

Solid wastes are all the wastes arising from human and animal activities that are normally solid and are discarded as useless or unwanted. Generation of solid waste is not a new phenomenon. It is as old as the human civilization. In the early days, before the advent of the industrial revolution, the major constituents of waste were domestic sewage and agricultural residues, which were biodegradable in nature. Since population was less and fallow land was in plenty, solid wastes could be conveniently disposed off in the countryside either on open ground or were placed in pits covered with layers of earth. Because of their biodegradable nature they used to get decomposed and assimilated in the soil. However, with unparallel industrialization and consequent organization not only has the quantity of the solid waste increased but its quality has also changed. Though rural wastes continue to be made up of domestic wastes and agricultural residues mainly, waste from urban areas and the industrial units contains diverse types of materials that include toxic and hazardous constituents. The discarded waste materials are often reusable and may be considered as resource in another setting. Solid Waste Management is to manage the society's waste in a manner that meets public health and environmental concerns and the public's desire to reuse and recycle waste materials.

Solid Waste Management may be defined as the discipline associated with the control of generation, collection, storage, transfer and transport, processing and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations.

The most commonly recognized methods for the final disposal of solid wastes are:

- Dumping on land
- Dumping in water
- Plowing into the soil
- Incineration

Waste Generation

Waste generation encompasses activities in which materials are identified as no longer being of value and are either thrown away or gathered together for disposal. For example, the wrapping of a chocolate is usually considered to be of little value to the owner once the chocolate is consumed and thrown away, especially outdoors. It is important in waste generation to note that there is an identification step, which varies with each individual waste. The quantity of solid waste generation depends upon factors such as standard of living, food habits and degree of commercial activities and the quality of the waste also varies seasonally. According to the study carried out by the Central Pollution Control Board (CPCB) during 2000, in Class I cities, the solid waste generation was about 0.4 kg/capita/day. In other cities, the average solid waste generation was 0.2 kg/capita/day. The quantity of solid waste generated is directly related to increase of urbanization. The present urban population of India is about 25% and is estimated to go up to 60% in 2025. In India currently about 1,00,000 metric tonnes of Municipal Solid Waste is generated in a day!!!

WHAT IS SOLID WASTE

Solid wastes are unwanted materials disposed by mankind. Between 2000 and 2025 the waste composition of Indian garbage will undergo the following changes

- Organic Waste will go up from 40 percent to 60 percent
- Plastic will rise from 4% to 6%
- Metal will escalate from 1% to 4%
- Glass will increase from 2% to 3%
- Paper will climb from 5% to 15%
- Others (ash, sand, grit) will decrease from 47% to 12%

Source: Toxics Link, 2002

WHAT IS LIQUID WASTE

Liquid waste means sludge resulting from, but not limited to, waste treatment, water treatment, air pollution control facility, domestic, commercial, mining, institutional, agricultural, or governmental operations; or other waste materials, including materials to be recycled or otherwise beneficially reused; or septic tank, grease trap, sediment trap, portable toilet, or oil and grease separator pump-outs; or solvents, sewage, industrial waste, hazardous waste, semisolid waste, or potentially infectious waste; or any similar materials which would cause a nuisance if discharged to the ground waters.

Liquid waste generator means any person or entity whose act or process produces liquid waste, or who by the nature of its operations uses materials in a process which would subsequently require disposal as a liquid waste .

Liquid waste transporters

means any person or entity who carries, conveys, bears or transports any liquid waste in any moving vehicle including but not limited to a car, truck, tank car, railroad car or other vehicle.

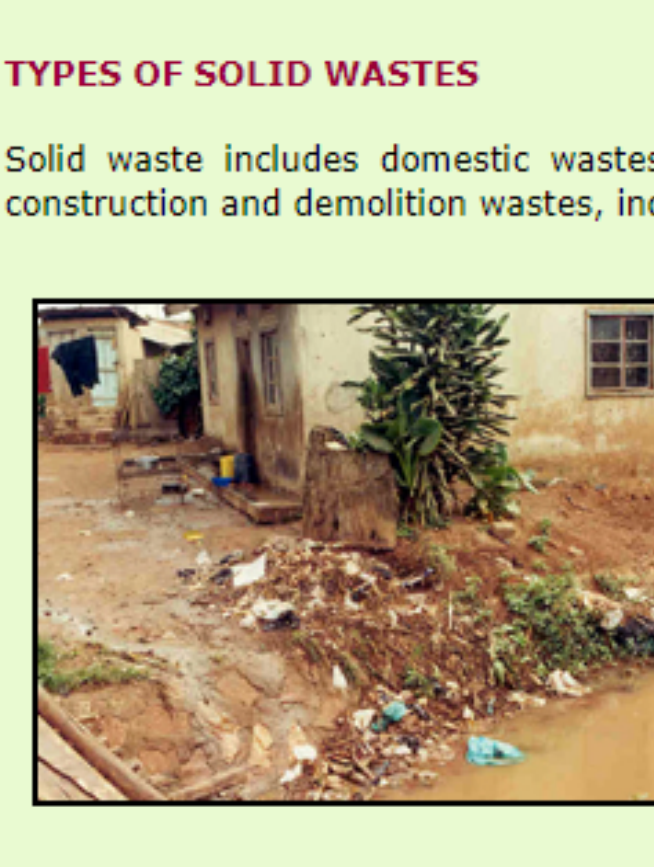
Prohibited Liquid Waste

There are a number of waste streams that due to their inherent nature or characteristics can adversely affect the operation of a landfill site and therefore should be prohibited from landfill disposal. The following are recommended as not being suitable for disposal to any type of landfill

- Radioactive wastes
- Lead acid batteries
- Used oil
- Explosive, flammable, oxidizing or corrosive substances

TYPES OF SOLID WASTES

Solid waste includes domestic wastes, municipal wastes, commercial wastes, garbage, rubbish, ashes, construction and demolition wastes, industrial wastes, hazardous wastes, hospital wastes and sewage.



Domestic wastes :These wastes are generated by household activities such as cooking, cleaning, repairs, redecoration, empty containers, packaging, clothing, old books, newspapers, old furnishings, etc.

Commercial wastes : Solid wastes generated in offices, wholesale stores, restaurants, hotels, markets, warehouses and other commercial establishments. These are further classified into garbage and rubbish.

Institutional wastes : Wastes generated from institutions such as schools, colleges, hospitals, research institutions. The waste includes garbage, rubbish and hazardous wastes.

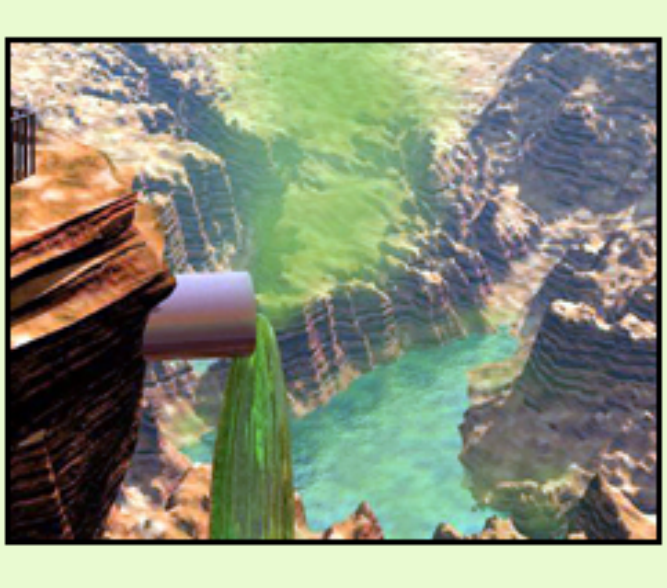
Municipal wastes :Wastes generated due to municipal activities and services such as street waste, deadanimals, market waste and abandoned vehicles. Generally, the term is used in a wider sense to incorporate domestic wastes, institutional wastes and commercial wastes.

Garbage: It includes animal and vegetable wastes due to various activities like storage, preparation and sale, cooking and serving. These are biodegradable.

Ashes: Residues from the burning of wood, charcoal and coke for cooking and heating in houses, institutions and small industries. Ashes consist of a fine powdery residue, cinders and clinker often mixed with small pieces of metal and glass.

Rubbish: Apart from garbage and ashes, other solid wastes produced in households, commercial establishments, and institutions are termed as rubbish.

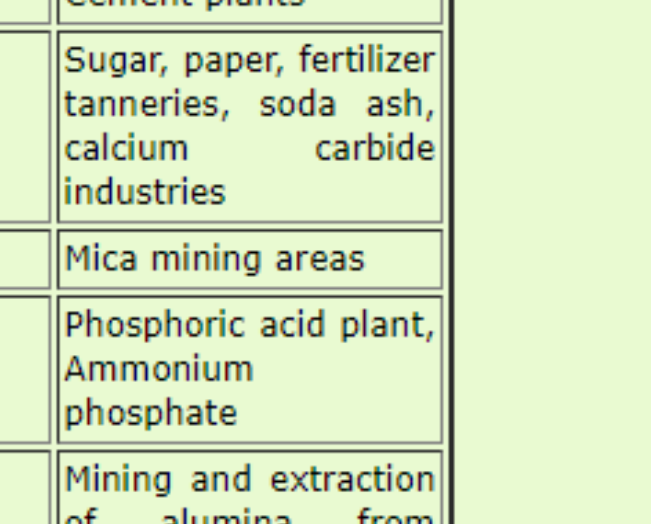
Bulky wastes: Bulky wastes are large household appliances such as cookers, refrigerators and washing machines as well as furniture, crates, vehicle parts, tyres, wood, trees and branches. The bulky metallic wastes are sold as scrap metal but some portion is disposed as sanitary landfills.



Street wastes: Street wastes include paper, cardboard, plastic, dirt, dust, leaves and other vegetable matter collected from streets, walkways, alleys, parks and vacant plots.

Dead animals: It includes animals that die naturally or accidentally killed. It does not include carcass and animal parts from slaughterhouses as these are considered as industrial wastes.

Construction and demolition wastes: India generates about 10 – 12 million tonnes of waste annually. Major components of the construction materials are cement, bricks, cement plaster, steel, rubble, stone, timber, plastic and iron pipes. About 50% of the wastes are not currently recycled in India and 70 % of the construction industry in India is not aware of recycling techniques.



Industrial wastes: These are discarded solid material of manufacturing processes and industrial operations and are considered separately from municipal wastes. However, solid wastes from small industries plants and ash from power plants are frequently disposed of at municipal landfills. Major producers of industrial wastes are the thermal power plants producing coal ash, integrated iron and steel mills producing blast furnace slag and steel melting slag, non-ferrous industries like aluminium, zinc and copper producing red mud and tailings, sugar industries generating press mud, pulp and paper industries producing lime and fertilizer and allied industries producing gypsum. Management of industrial solid waste is not the responsibility of local bodies. Industries generating solid wastes have to manage by themselves and are required to obtain prior permission from the respective state pollution control boards under relevant rules.

Source and quantum of some major industrial wastes

Sl.No.	Name	Quantity (Million tonnes per annum)	Source
1	Steel and Blast Furnace	35.0	Conversion of steel
2	Brine mud	0.02	Caustic soda industry
3	Copper slag	0.0164	By product from smelting of copper
4	Fly ash	70.0	Coal based thermal power plants
5	Kiln dust	1.6	Cement plants
6	Lime sludge	3.0	Sugar, paper, fertilizer tanneries, soda ash, calcium carbide industries
7	Mica scraper waste	0.005	Mica mining areas
8	Phosphogypsum	4.5	Phosphoric acid plant, Ammonium phosphate
9	Red mud / Bauxite	3.0	Mining and extraction of alumina from Bauxite
10	Coal washery dust	3.0	Coal mines
11	Iron tailing	11.25	Iron Ore
12	Lime stone wastes	50.0	Lime stone quarry

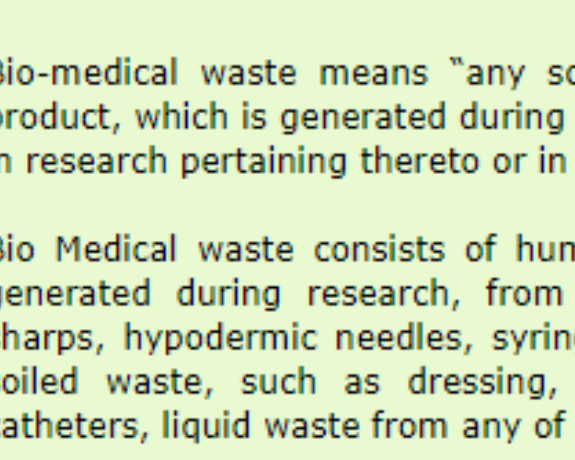
Source: Manual on Municipal Solid Waste Management, CPHEEO, New Delhi

Slaughter House Waste

India has the world's largest population of livestock. According to the Ministry of Food Processing, a total of 3616-slaughter houses slaughter over 2 million cattle and buffaloes, 50 million sheep and goat, 1.5 million pigs and 150 million poultry annually, for domestic consumption as well as for export purposes. The waste generated here are liquid and solid in nature. Slaughtering of animals generates waste consisting of non-edible organs, stomach contents, dung, bones and sludge from waste water treatment. Central Pollution Control Board has brought out "Draft guidelines for sanitation in slaughter houses" during August 1998.

Slaughter house types	Waste generated
Large	6 – 7 tonnes / day
Medium	2 – 6 tonnes / day
Small	0.5 – 1 tonnes / day

Hospital waste



Hospital waste is generated during the diagnosis, treatment immunization of human beings or animals. It may include wastes like sharps, soiled waste, disposables, anatomical waste, cultures, discarded medicines, chemical wastes, etc. These are in the form of disposable syringes, swabs, bandages, body fluids, human excreta, etc. This waste is highly infectious and can be a serious threat to human health if not managed in a scientific manner. It has been roughly estimated that of the 4 kg of waste generated in a hospital at least 1 kg would be infected.

Surveys carried out by various agencies show that the health care establishments in India are not giving due attention to their waste management. After the notification of the Bio-medical Waste (Handling and Management) Rules, 1998, these establishments are slowly streamlining the process of waste segregation, collection, treatment, and disposal. Many of the larger hospitals have either installed the treatment facilities or in the process of doing so.

Bio-medical waste

Bio-medical waste means "any solid and/or liquid waste including its container and any intermediate product, which is generated during the diagnosis, treatment or immunisation of human beings or animals or in research pertaining thereto or in the production or testing thereof."

Bio Medical waste consists of human anatomical waste like tissues, organs, body parts, animal wastes generated during research, from veterinary hospitals, microbiology and biotechnology wastes, waste sharps, hypodermic needles, syringes, scalpels, broken glass, discarded medicines and cyto-toxic drugs, soiled waste, such as dressing, bandages, plaster casts, material contaminated with blood, tubes, catheters, liquid waste from any of the infected areas, incineration ash and other chemical wastes.

Several health hazards are associated with poor management of bio-medical wastes like injury from sharps to staff and waste handlers associated with the health care establishments. Hospital Acquired Infection (HAI) of patients due to spread of infection. Occupational risk associated with hazardous chemicals, drugs, unauthorized repackaging and sale of disposable items and unused/date expired drugs.

The Bio-medical waste (Management & Handling Rules), 1998 is applicable to all persons, who generate, collect, receive, store, transport, treat, dispose or handle bio-medical waste in any form. The occupier of an institution generating bio-medical waste is required to take all steps to ensure that such waste is handled without any adverse effect on human health and the environment.

Occupier in relation to any institution generating bio-medical waste, which includes the hospital, nursing home, dispensary, clinic, veterinary institution, animal house, pathological laboratory, blood bank, means a person who has control over that institution or its premises.

Every occupier shall set up bio-medical waste treatment facilities like incinerator, autoclave and microwave system to treat and dispose such waste.

- For human anatomical waste (human tissues, organs, body parts) the recommended treatment is incineration or deep burial.
- wastes such as needles, syringes, scalpels, blades, glass, etc., are required to undergo the chemical treatment, autoclaving or shredding.
- Solid waste items contaminated with blood and body fluids including cotton, dressing, soiled plaster casts, bedding and other materials are to be treated by incineration, autoclaving or microwaving.
- Solid wastes generated from disposable items such as tubes, catheters, intravenous sets are to be disinfected by chemical treatment or microwaving and shredding.

Bio-medical waste shall not be mixed with other wastes and shall be segregated into containers or bags of different colours like yellow, red, blue and black depending upon the type of waste. The untreated bio-medical waste should not be stored in the premises beyond a period of 48 hours and shall be transported only in such vehicles authorized for the purpose by the Government.

The environmental considerations must form an integral part of all development and be supplemented by mechanisms to see that environmental safeguards are actually implemented together with systematic monitoring to assess the effectiveness of such precautions in protecting the environment. It is proposed to appoint an advisory committee constituting members from medical, health care, veterinary, environment management, municipality and other related departments to provide suitable advice.

Some common parasites and pathogens associated with solid waste

Organisms	Time and Temperature for destruction
S. Typhosa	No growth beyond 46o C, death in 30 minutes at 55-60o and 20 minutes at 60o C, destroyed in a short time in compost environment
Salmonella sp.	In 1 hour at 55o C and in 15-20 minutes at 60o C.
Shigella sp.	In 1 hour at 55o C.
E. Coli	In 1 hour at 55o C. & in 15-20 minutes at 60o C.
E. histolytica cysts	In few minutes at 45o C. and in few seconds at 55o C.
Taenia saginata	In a few minutes at 55o C.
Trichinella spiralis larvae	Quickly killed at 55o C, instantly at 60o C.
Br. Abortus or Br. Suis	In 3 minutes at 62-63o C and in 1 hour at 55o C.
Micrococcus pyogenes var. aureus	In 10 minutes at 54o C.
Streptococcus pyogenes	In 10 minutes at 54o C.
Mycobacterium tuberculosis var. hominis	In 15-20 minutes at 66o C. or after momentary heating at 67o C.
Corynebacterium diptheriae	In 45 minutes at 55o C.
Necator americanus	In 50 minutes at 45o C.
A. lumbricoides eggs	In 1 hour at 50o C.

PLASTICS

Plastic, with its exclusive qualities of being light yet strong and economical, has invaded every aspect of our day-to-day life. It has many advantages: it is durable, light, easy to mould and can be adapted to different user requirements. Once hailed as a 'wonder material', plastic is now a serious worldwide environmental and health concern, essentially due to its non-biodegradable nature. More than 50% of the plastic waste generated in the country is recycled and used in the manufacture of various plastics products.

Dioxin is a highly carcinogenic and toxic by-product of the manufacturing process of plastics. Burning of plastics, especially PVC, releases this dioxin and also furan into the atmosphere.

Plastics are so versatile in use that their impact on the environment is extremely wide ranging. Careless disposal of plastic bags chokes drains, blocks the porosity of the soil and causes problems for groundwater recharge. Plastic disturbs the soil microbial activity. Plastic bags contaminate foodstuffs due to leaching of toxic dyes and transfer of pathogens. In fact, a major portion of the plastic bags i.e. approximately 60-80% of the plastic waste generated in India is collected and segregated for recycling. 20 - 40% remains strewn on the ground, littered around in open drains.

Designing eco-friendly, biodegradable plastics are the need of the hour. Though partially biodegradable plastics have been developed and used, completely biodegradable plastics based on renewable starch rather than petrochemicals have only recently been developed and are in the early stages of commercialization. The incentives provided for this is not adequate. For example it is both easy and economical to deliver milk in plastic bags rather than in bottles.

Household	Health and Medicare
Carry bags Pet bottles Containers Trash bags	Disposable syringes Glucose bottles Blood and uro bags Intravenous tubes Catheters Surgical gloves
Hotel and Catering	**Air/Rail Travel**
Packaging items Mineral water bottles Plastic plates, cups, spoons	Mineral water bottles Plastic plates, cups, spoons Plastic bags

Source of generation of waste plastics

Problems of solid wastes

Consumption, linked to per capita income, has a strong relationship with waste generation. As per capita income rises, more savings are spent on goods and services, especially when the transition is from a low income to a middle-income level. India will probably see a rise in waste generation from less than 40,000 metric tonnes per year to over 125,000 metric tones by the year 2030.

In 1947 cities and towns in India generated an estimated 6 million tonnes of solid waste; in 1997 it was about 48 million tonnes. More than 25% of the municipal solid waste is not collected at all; 70% of the Indian cities lack adequate capacity to transport it and there are no sanitary landfills to dispose of the waste. The existing landfills not lined properly to protect against contamination of soil and groundwater.

Garbage	Four broad categories
Organic waste	kitchen waste, vegetables, flowers, leaves, fruits.
Toxic waste	old medicines, paints, chemicals, bulbs, spray cans, fertilizer and pesticide containers, batteries, shoe polish
Soiled	hospital waste such as cloth soiled with blood and other body fluids.
Recyclable	paper, glass, metals, and plastics

Generation of Municipal Solid Waste

Composition	Percentage
Biodegradable	52%
Metal scrap, Rubber, textiles, etc	11%
Stones and Rubber	8%
Sand	23%
Plastics	10%
Paper products	5%

Municipal Solid Wastes

Municipal solid waste includes commercial and domestic wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes.

Collection of municipal solid wastes

Littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the State Governments. To prohibit littering and facilitate compliance, the following steps shall be taken by the municipal authority, namely

1. Organizing house-to-house collection of municipal solid wastes through any of the methods, like community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using musical bell of the vehicle.
2. Devising collection of waste from slums and squatter areas or localities including hotels, restaurants, office complexes and commercial areas.
3. Wastes from slaughterhouses, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature, shall be managed to make use of such wastes.
4. Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose.
5. Collected waste from residential and other areas shall be transferred to community bin by hand-driven carts or other small vehicles.
6. Construction or demolition wastes or debris shall be separately collected and disposed off following proper norms. Similarly, wastes generated at dairies shall be regulated in accordance with the State laws.
7. Waste (garbage, dry leaves) shall not be burnt.
8. Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town.

Generation of Municipal Solid waste in various countries

Country	Urban MSW Generation (kg/capita/day)	
	In 1995	In 2025
Japan	1.47	1.30
Singapore	1.10	1.10
Hong Kong	5.07	4.50
Korea	1.59	1.40
Malaysia	0.81	1.40
Thailand	1.10	1.15
Philippines	0.52	0.80
Indonesia	0.76	1.00
Sri Lanka	0.89	1.00
China	0.79	0.90
India	0.46	0.70
Mangolia	0.60	0.90
Vietnam	0.55	0.70
Myanmar	0.45	0.60
Bangladesh	0.49	0.60
Nepal	0.50	0.60

Source: Manual on Municipal Solid Waste Management, Govt. of India, 2000

Various problems are faced due to solid waste disposal. Dumping of solid wastes in the open could create aesthetic problems as the beauty of a place is destroyed. The garbage forms a source of food for rats, flies, mosquitoes and the like. Hence typhoid, plague, dysentery, diarrhoea epidemics could occur. Toxic hazardous substances in the wastes would be harmful to human and animal health. The plastics if eaten by cows could be fatal. Solid wastes could also pollute water and their burning could lead to air pollution.

SOLID WASTE MANAGEMENT AND THE LAW

Laws concerning solid waste are passed to improve the solid waste management and to regulate the disposal activity, which causes problems in public health, the environment and economics. Many laws apply to the control of solid waste management problems.

Acts, Rules and Notification regarding Solid Waste Management in Inida

- Law of Torts
- Indian Penal Code, 1860
- Code of Civil Procedure, 1908
- Constitution of India, 1950
- Code of Criminal Procedure, 1973
- Water (Prevention and Control of Pollution) Act, 1974
- The Air (Prevention and Control of Pollution) Act, 1981
- Environment Protection Act, 1986
- Hazardous waste (Management & Handling) Rules, 1989
- Coastal Regulation Zone Notification, 1991
- Bio-medical wastes (Management & Handling) Rules, 1998.
- Recycled plastics (Manufacture and Usage) Rules, 1999
- Municipal Waste (Management and Handling) Rules 2000

The right to live in a clean and healthy environment is not only a fundamental right guaranteed under Article 21 of our Constitution but also a right recognized and enforced by the courts of law under different laws, like Law of Torts, Indian Penal Code, 1860 Civil Procedure Code, 1908 and Criminal Procedure Code, 1973. **The Constitution of India, 1950 the earliest legislation and which is the supreme law of the land has imposed a fundamental duty on every citizen of India under Article 51-A(g) to protect and improve the environment.** The obligation on the State to protect the environment is expressed under Article 48 A. The right to live in a healthy environment is also a basic human right. The Universal Declaration of Human Rights, 1948 has declared under Article 3 that everyone has a right to life and under Article 25 that everyone has a right to a standard of living adequate for health and well being of himself and of his family.

At the national policy level, the ministry of environment and forests has legislated the Municipal Waste Management and Handling Rules 2000 in exercise of the power conferred under sections 3, 6 and 25 of the Environment Protection Act, 1986. These rules shall apply to every municipal authority responsible for collection, segregation, storage, transportation, processing and disposal of municipal solid wastes.

Composting of wastes is a legal requirement provided under the Municipal Solid Waste Management (MSW) Rules 2000 for all municipal bodies in the country. The MSW Rules 2000 requires that "biodegradable wastes shall be processed by composting, vermi-composting, anaerobic digestion or any other appropriate biological processing for the stabilization of wastes". The specified deadline for setting up of waste processing and disposal facilities was 31 December 2003 or earlier.

Every municipal authority shall, within the territorial area of the municipality, be responsible for the implementation of the provisions of these rules, and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.

The Central Government, to perform its functions effectively as contemplated under sections 6, 8, and 25 of the Environment Protection Act, 1986, and has made various Rules, Notifications and Orders including the Bio-medical wastes (Management & Handling) Rules, 1998.

Recycled plastics (Manufacture and Usage) Rules, 1999

- Prohibit the usage of carry bags or containers made of recycled plastics for storing, carrying, dispensing or packaging of foodstuffs.
- Prescribe that the minimum thickness of carry bags made of recycled plastics shall not be less than 20 microns.
- Directs the manufacturers of carry bags that the carry bags and containers shall be in natural shape or white in colour.
- Stipulate that recycling of plastics shall be undertaken strictly in accordance with the standards prescribed by the Bureau of Indian Standards. The manufacturers of recycled plastics carry bags shall mark their products as "recycled".

This notification also provides that the Plastics Industries Association through member units shall undertake self-regulatory measures. The State Pollution Control Board exercise powers to implement and control the above rules.

What is the responsibility of the State Government and the Union territory?

- The Secretary-in charge of the Department of Urban Development of the concerned State or the Union territory, as the case may be, shall have the overall responsibility for the enforcement of the provisions of these rules in the metropolitan cities.
- The District Magistrate or the Deputy Commissioner of the concerned district shall have the overall responsibility for the enforcement of the provisions of these rules within the territorial limits of their jurisdiction.

Preliminary surveys on municipalities' preparedness in implementing the MSW Rules 2000 show that the majority of the cities including Tamilnadu have embarked on city-wide implementation of door-to-door collection of wastes, source segregation, composting of organics, recycling and creating engineered and safe landfill sites for residual waste disposal. The municipalities were given three years time to make such preparations.

What is the responsibility of the citizens of India?

There is a constitutional obligation under Article 51A(g) to protect the environment. The question before us is whether we as citizens of India have fulfilled our part of the obligation?

In Plato's words, "We are still like cave men, with our backs turned to the light, watching the shadows on the wall".

Segregation of municipal solid wastes

In order to encourage the citizens, municipal authority shall organize awareness programmes for segregation of wastes and shall promote recycling or reuse of segregated materials. The municipal authority shall undertake phased programme to ensure community participation in waste segregation. For this purpose, the municipal authorities shall arrange regular meetings at quarterly intervals with representatives of local resident welfare associations and non-governmental organizations.

Storage of municipal solid wastes

Municipal authorities shall establish and maintain storage facilities in such a manner, as they do not create unhygienic and unsanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities, namely:

- Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities. A storage facility shall be so placed that it is accessible to users.
- Storage facilities to be set up by municipal authorities or any other agency shall be so designed that wastes stored are not exposed to open atmosphere and shall be aesthetically acceptable and user-friendly.
- Storage facilities or 'bins' shall have 'easy to operate' design for handling, transfer and transportation of waste. Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be painted white and those for storage of other wastes shall be painted black.

Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.

Processing of municipal solid wastes

Municipal authorities shall adopt suitable technology or combination of such technologies to make use of wastes so as to minimize burden on landfill. Following criteria shall be adopted, namely

- The biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes.

Mixed waste containing recoverable resources shall follow the route of recycling. Incineration with or without energy recovery can also be used for processing wastes in specific cases. Municipal authority or the operator of a facility wishing to use other state-of-the-art technologies shall approach the Central Pollution Control Board to get the standards laid down before applying for grant of authorization.

Disposal of municipal solid wastes

Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Land filling shall also be carried out for residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Land filling of mixed waste shall be avoided unless the same is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, land filling shall be done following proper norms.

Managing Non-biodegradable solid waste (NBDSW)

Non-biodegradable solid waste (NBDSW) or refuse is a carpet word. It covers a variety of materials ranging from asbestos to Zinc batteries. Polythene and its related compounds are the most commonly found solid waste materials in urban environs. Many non-biodegradable solid waste materials are known to cause considerable environmental hazards when released into land, water and atmosphere.

Coastal environment and social waste management

Solid waste related problems prevail more in megalopolis and the dangers reach great heights in coastal cities. Solid wastes of domestic and industrial units are considered major pollutants of coastal regions of India. Nearly 44000 m3 of domestic sewage and 440 m3 of industrial waste are discharged every year into the seas of India.

Application of some important industrial wastes

S.No.	Waste	Areas of application
1	Fly ash	• Cement • Raw material in Ordinary Portland Cement (OPC) manufacture • Manufacture of oil well cement • Making sintered fly ash light-weight aggregates • Cement / silicate bonded fly ash/clay binding bricks and insulating bricks • Cellular concrete bricks and blocks, lime and cement fly ash concrete • Precast fly ash concrete building units • Structural fill for roads, construction on sites, land reclamation, etc. • As filler in mines, in bituminous concrete • As plasticiser • As water reducer in concrete and sulphate resisting concrete
2	Blast Furnace Slags	• Manufacture of slag cement, super sulphated cement, metallurgical cement • Non-portland cement • Making expansive cement, oil well, coloured cement and high early-strength cement • In refractory and in ceramic as sital • As a structural fill (air-cooled slag) • As aggregate in concrete
3	Ferro-alloy & other metallurgical slags	• As structural fill • In making pozzolona metallurgical cement
4	By product gypsum	• In making of gypsum plaster, plaster boards and slotted tiles • As set controller in the manufacture of portland cement • In the manufacture of expensive or non-shrinking cement, super sulphated and anhydrite cement • As mineraliser • Simultaneous manufacture of cement and sulphuric acid
5	Lime sludge (phos-phochalk paper and sugar sludges)	• As a sweetener for lime in cement manufacture • Manufacture of lime pozzolana bricks / binders • For recycling in parent industry • Manufacture of building lime • Manufacture of masonry cement
6	Chromium sludge	• As a raw material component in cement manufacture • Manufacture of coloured cement as a chromium – bearing material
7	Red mud	• As a corrective material • As a binder • Making construction blocks • As a cellular concrete additive· Coloured composition for concrete • Making heavy clay products and red mud bricks • In the formation of aggregate • In making floor and all tiles • Red mud polymer door
8	Pulp and paper	• Lignin

Source: Manual on Municipal Solid Waste Management, CPHEEO, New Delhi

Waste Management at source

Source of waste generation	Action to be taken
Household	• Not to throw any solid waste in the neighbourhood, on the streets, open spaces, and vacant lands, into the drains or water bodies • Keep food waste/biodegradable waste in a non corrosive container with a cover (lid) • Keep dry, recyclable waste in a bin or bag or a sack • Keep domestic hazardous waste if and when generated separately for disposal at specially notified locations
Multi-storeyed buildings commercial complexes private societies	• Provide separate community bin or bins large enough to hold food/biodegradable waste and recyclable waste generated in the building or society. • Direct the members of the association to deposit their waste in community bin
Slums	• Use community bins provided by local body for deposition of food and biodegradable waste
Shops, offices, institutions, etc	• If situated in a commercial complex, deposit the waste in bins provided by the association
Hotels & restaurants	• The container used should be strong, not more than 100 litre in size, should have a handle on the top or handles on the sides and a rim at the bottom for easy handling
Vegetable & Fruit Markets	• Provide large containers, which match with transportation system of the local body. • Shop keepers not to dispose of the waste in front of their shops or open spaces. Deposit the waste as and when generated into the large container placed in the market.
Meat & fish markets	• Not to throw any waste in front of their shops or open spaces around. Keep non-corrosive container/containers not exceeding 100-litre capacity with lid handle and the rim at the bottom and deposit the waste in the said containers as and when generated. • Transfer the contents of this container into a large container provided by the association.
Street food vendors	• Not to throw any waste on the street, pavement or open spaces. Keep bin or bag for the storage of waste that generates during street vending activity • Preferably have arrangements to affix the bin or bag with the hand–cart used for vending.
Marriage halls, community halls, kalyanamandapas	• Not to throw any solid waste in their neighbourhood, on the streets, open spaces, and vacant lands, into the drains or water bodies. • Provide a large container with lid which may match with the transportation system of the local body and deposit all the waste generated in the premises in such containers.
Hospitals, Nursing homes, etc	• Not to throw any solid waste in their neighbourhood, on the streets,open spaces, and vacant lands, into the drains or water bodies. • Not to dispose off the biomedical waste in the municipal dust bins or other waste collection or storage site meant for municipal solid waste. • Store the waste as per the directions contained in the government of India, Ministry of Environment Biomedical Waste (Management & Handling) Rules, 1998.
Construction/ demolition waste	• Not to deposit construction waste or debris on the streets, footpaths, pavements, open spaces, water bodies etc. • Store the waste within the premises or with permission of the authorities just outside the premises without obstructing the traffic preferably in a container if available through the local body or private contractors.
Garden waste	• Compost the waste within the garden, if possible Trim the garden waste once in a week on the days notified by the local body. • Store the waste into large bags or bins for handing over to the municipal authorities appointed for the purpose on the day of collection notified.

Some items that can be recycled or reused

Paper

- Old copies
- Old books
- Paper bags
- Newspapers
- Old greeting cards
- Cardboard box

Plastic

- Containers
- Bags
- Sheets

Glass and ceramics

- Bottles
- Plates
- Cups
- Bowls

Miscellaneous

- Old cans
- Utensils
- Clothes
- Furniture

ROLE OF NGOs

During the recent years, NGOs (non-governmental organizations) have taken up initiatives to work with local residents to improve sanitation. They have been playing an active role in organizing surveys and studies in specified disciplines of social and technological sciences. In the field of garbage management, such studies are useful in identifying areas of commercial potentials to attract private entrepreneurs. They can play an important role in segregation of waste, its collection and handling over to local authorities.

A large number of NGOs are working in the field of solid waste management such as Clean Ahmedabad Abhiyan, Ahmedabad, Waste-Wise, Bangalore, Exnora, Chennai, Mumbai Environmental Action Group, Mumbai, and Vatavaran and Srishti in Delhi. They are all successfully creating awareness among the citizens about their rights and responsibilities towards solid waste and the cleanliness of their city. These organizations promote environmental education and awareness in schools and involve communities in the management of solid waste.

The NGO programmes:

q Create mass awareness, ensuring public participation in segregation of recyclable material and storage of waste at source.
q Provide employment through organizing door-to-door collection of waste.
q Ensure public participation in community based primary collection system.
q Encourage minimization of waste through in-house backyard composting, vermicomposting and biogas generation.

Urban poverty is inextricably linked with waste. In India alone, over a million people find livelihood opportunities in the area of waste; they are engaged in waste collection (popularly known as rag picking) and recycling through well-organized systems. Substantial populations of urban poor in other developing countries also earn their livelihood through waste. It is important to understand issues of waste in this context. The informal sector dealing with waste is engaged in various types of work like waste picking, sorting, and recycling at the organized level, door-to-door collection, composting and recycling recovery.

THE ROLE OF RAG PICKERS

Rag pickers are the people who are actually going through the garbage bins, dumping sites to pick out the 'rags'. These rag pickers: women, children, and men from the lowest rung in the society, are a common sight in most cities and towns around the country. Rag picking is considered the most menial of all activities and it is people who have no other alternative that are generally driven to it. Rag pickers contribute a great deal towards waste management as they scavenge the recyclable matter thereby saving the municipality of the cost and time of collecting and transporting this to the dumps.

They are one of the focal points for the recycling of waste. They are the persons who, in spite of all the dangers that they faces, goes on relentlessly picking through the garbage bin, looking for waste that could be useful to them. They sell all the material they picked to the whole sellers and retailers who in turn sell it to the industry that uses this waste matter as raw material. The main items of collection are plastics, paper, bottles, and cans.

While picking through waste, the rag pickers puts themself at a great risk and is always prone to disease as the waste that they rummages through can be infected. We can indirectly help the rag pickers by carefully segregating the waste that is generated at our homes, thereby facilitating their search for materials that are useful to them. They will not have to scavenge in the bins/yards for long hours.

Occupational hazards associated with waste handling Infections

- Skin and blood infections resulting from direct contact with waste, and from infected wounds.
- Eye and respiratory infections resulting from exposure to infected dust.
- Different diseases that results from the bites of animals feeding on the waste.
- Intestinal infections that are transmitted by flies feeding on the waste.

ROLE OF POLLUTION CONTROL BOARDS

Since the disposal of municipal solid wastes poses problems of the pollution and health hazards, the Pollution Control Boards are expected to take action for persuading the civic authorities in proper management of municipal solid wastes. Though, direct responsibility of management of solid wastes is on the local municipal authorities, the Pollution Control Boards need to have close linkage with local authorities in rendering assistance in terms of carrying out necessary surveys and providing technological back-up. The Central Pollution Control Board and the State Pollution Control Boards at the national and state levels are to disseminate information and create awareness among the concerned authorities and public at large.

Action Taken

The Central Pollution Control Board (CPCB) and the State Pollution Control Boards (SPCBs) within the given powers to them under relevant Acts and Rules have been attempting to persuade local bodies to take appropriate measures for the treatment and disposal of domestic sewage and municipal solid waste.

Directions

In order to initiate a systematic approach on proper management of municipal waste (sewage and solid), CPCB issued directions to all SPCBS under section 18 of the Water (Prevention and Control of Pollution) Act, 1974.
Follow-ups on Directions

In compliance to the directions of the CPCB and through initiatives of SPCBs some actions have been taken. Also SPCBs have issued notices to local bodies in the states/ UTs and impressed upon them to take proper measures.

WHAT CAN YOU DO TO REDUCE SOLID WASTE

- Carry your own cloth or jute bag when you go shopping.
- Say no to all plastic bags as far as possible.
- Reduce the use of paper bags also. (reason?)
- Reuse the soft drinks poly bottles for storing water.
- Segregate the waste in the house – keep two garbage bins and see to it that the biodegradable and the non biodegradable is put into separate bins and dispose off separately.
- Dig a compost pit in your garden and put all the bio degradable into it.
- See to it that all garbage is thrown into the municipal bin as the collection is generally done from there.
- When you go out do not throw paper and other wrappings or even leftover food here and there, make sure that it is put in the correct place that is into a dustbin.
- Not to throw the waste/litter on the streets, drains, open spaces, water bodiesetc.,
- Storage of organic/bio-degradable and recyclable waste separately at source
- Community storage/collection of waste in flats, multi-storied buildings, societies, commercial complexes, etc.
- Managing excreta of pet dogs and cats appropriately.
- Waste processing/disposal at a community level (optional).
- Pay adequately for the services provided.
- Public education.

The materials and illustrations used in this publication have been taken from the following:

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