

Waste
management

Introduction

About waste

According to the Basel Convention, wastes are substances or objects that are disposed or are intended to be disposed or are required to be disposed by the provisions of national laws. Waste includes all items that people no longer have any use for, which they either intend to get rid of or have already discarded. Additionally, wastes are such items which people are required to discard, for example by law because of their hazardous properties. Many items can be considered as waste e.g., household rubbish, sewage sludge, wastes from manufacturing activities, packaging items, discarded cars, old televisions, garden waste, old paint containers etc. Thus, all our daily activities give rise to a large variety of different waste arising from different sources. The rising quality of life and high rates of resource consumption patterns have had an unintended and negative impact on the environment by generation of waste far beyond the handling capacities of governments and agencies. Cities are now grappling with the problems of high volumes of waste, the costs involved, the disposal technologies and methodologies and the impact of waste on the local and global environment.

Kinds of waste

Modern urban living brings on the problem of waste, which increases in quantity and changes in composition with each passing day. The different kinds of waste are:

- Municipal waste: Waste generated by households consisting of paper, plastic, packaging, organic waste, metals etc.
- Industrial and hazardous waste: Consists of waste generated during the manufacturing process which turns raw materials into consumer products. Some of this waste can also be hazardous.
- Biomedical waste: Waste generated by hospitals and other health providers consisting of discarded drugs, waste sharps, microbiology and biotechnology waste, human anatomical waste, animal waste etc.
- Construction and demolition waste: Waste arising from activities such as the construction and demolition of buildings, creation of infrastructure such as road planning and maintenance etc.
- Mining waste: Waste arising from prospecting, extraction, treatment and storage of minerals.
- E- waste: This consists of end of life products and comprises of a range of electrical and electronic items such as information technology and telecommunication equipment like computers and printers, electrical and electronic tools, washing machines, medical equipment, refrigerators, televisions etc.
- Radioactive waste: Waste that contains a concentration of radio nuclides greater than those deemed safe by national authorities and for which no use is foreseen. Because of the wide variety of nuclear applications, the amounts, types and even physical forms of radioactive waste vary considerably. Some of these wastes remain

radioactive for hundreds or thousands of years, while others may require storage for only a short period, while they decay, prior to conventional disposal.

- Other waste: These include end-of-life vehicles, packaging waste, tyres, batteries, agricultural waste, waste from forestry etc.

Impact of waste on health and environment

Waste represents a threat to the environment and human health if not handled or disposed properly. Surface water contamination takes place when waste reaches water bodies. Ground water contamination takes place when residues from waste leach into the ground water. Residues from waste can change the water chemistry which can affect all levels of an ecosystem. Both surface and ground water contamination can impact the health of lower food chain organisms and consequently, the availability of food through the food chain. It can damage the health of wetlands and impair their ability to support healthy ecosystems, control flooding and filter pollutants from storm water runoff. The health of animals and humans are affected when they drink or bathe in contaminated water. In addition, aquatic organisms, like fish and shellfish, can accumulate and concentrate contaminants in their bodies. Water from these contaminated sources when used for irrigation can affect soil productivity as well as introduce contaminants into the food chain.

A specific environmental hazard caused by waste is leachate, which is the liquid that forms as water trickles through contaminated areas, leaching out chemicals. Movement of leachate from landfills, effluent treating plants and waste disposal sites may result in hazardous substances entering surface water, ground water or soil.

Soil contamination as a result of waste can harm plants when they take up contaminants from their roots. Ingesting, inhaling or touching soil contaminated by waste, as well as eating plants or animals that have accumulated soil contaminants can adversely impact the health of humans and animals. Emissions from incinerators or other waste burning devices and from landfills can also cause air contamination. Incinerators routinely emit dioxins, furans and polychlorinated by-phenyls (PCB), which are deadly toxins, causing cancer and endocrine system damage. Other conventional toxins such as mercury, heavy metals are also released.

Landfills are a big source of release of green house gases which are generated when organic waste decomposes in landfills. Thus, improper handling of waste has consequences both on the environment as well as on the health of the people. Risks to human health and environment are acute when electronic and electrical waste is not managed properly. E-waste contains a mix of toxic substances such as lead and cadmium in circuit boards, lead oxide and cadmium in monitor cathode ray tubes, mercury in switches and flat screen monitors, cadmium in computer batteries, PCBs in older capacitors and transformers and brominated flame retardants on printed circuit boards, plastic casings, cables and polyvinyl chloride cable insulation that release highly toxic dioxins and furans when burned to retrieve copper from the wires. Due to the hazards involved, disposing and recycling e-waste has serious health and environmental implications.

Waste Management

According to European Union Directive on waste, 'waste management' shall mean 'the collection, transport, recovery and disposal of waste, including the supervision of such operations and after-care of disposal sites'. There are a number of newer concepts about waste management which vary in their usage between countries/regions. The most widely accepted concept is the waste hierarchy which classifies waste management strategies according to their desirability. According to this hierarchy, the priority of any country should be to extract the maximum practical benefits from products and prevent/minimize the waste that is generated. This hierarchy is a stepwise approach to waste management in the order of environmental priority for different waste management options as detailed in the waste pyramid illustrated above.

The general principle of the waste hierarchy are prevention, minimization, reuse, recycling, energy recovery and disposal with prevention being the most favoured and disposal being the least favoured option. Thus, strategies should focus on waste prevention and minimization through the '3 Rs' - reduce, reuse and recycle. According to this hierarchy, waste disposal strategies are 'end of the pipe' solutions and should be the least favoured option. Emphasis on waste prevention and waste minimisation would ensure that less waste is being produced which needs to be disposed.

Waste Prevention

Waste prevention means measures aiming at the reduction of the quantity and harmfulness of diverse waste streams for the environment. Prevention is the most desirable waste management option as it eliminates the need for handling, transporting, recycling or disposal of waste. It provides the highest level of environmental protection by optimizing the use of resources and by removing a potential source of pollution. Some of the techniques of waste prevention are improvement of resource efficiency, reduction of hazardous substances in products, life cycle thinking etc.

- Reducing waste includes any process or activity that avoids, reduces or eliminates waste at its source or results in reuse or recycling.
- Reusing is using an article more than once. This includes conventional reuse where the item is used again for the same function and new-life reuse where it is used for a new function.
- Recycling involves the treatment or reprocessing of a discarded waste material to make it suitable for subsequent reuse either for its original form or for other purposes. It includes recycling of organic wastes but excludes energy recovery. Recycling benefits the environment by reducing the use of virgin materials. Recycling is beneficial in two ways: it reduces the inputs (energy and raw materials) to a production system and reduces the amount of waste produced for disposal.

Some of the reduction and reuse strategies are: promotion of clean technologies and products, establishment of technical standards to limit the presence of certain dangerous

substances in products, eco-audit , reuse of scrap material, waste exchanges , ship to the point of use , deposit refund schemes , promoting the use of refill packs, extended producer responsibility and product stewardship .

Environmental legislation relating to waste in India

Primary rules relating to waste management

The management and handling of bio-medical waste, municipal solid waste, hazardous waste, recycled plastics, fly ash and waste batteries are governed under specific rules made under the Environment Protection Act, 1986. Rules/guidelines for other kinds of waste like demolition and debris waste, packaging waste, agricultural and forestry waste etc., have not yet been framed and the guidelines for management of e-waste is being finalized by the ministry of Environment and Forests. These laws and rules are also applicable to the state government and the state government can only make the provisions set out in these rules more stringent. These rules are:

- The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008.
- The Batteries (Management and Handling) Rules, 2001.
- The Municipal Solid Wastes (Management and Handling) Rules, 2000.
- The Recycled Plastics Manufacture and Usage Rules, 1999 and The Recycled Plastics Manufacture and Usage (Amendment) Rules, 2003.
- The Bio-Medical Waste (Management and Handling) Rules, 1998 and Bio-Medical Waste (Management and Handling) (Amendment) Rules, 2003.

Supporting policies/legislations

These policies/legislations do not specifically talk about waste but they do refer to the pollution caused by waste. Before embarking on audit on waste management, it is essential that auditors go through the provisions of these policies/legislations.

Environment Protection Act, 1986—In the wake of Bhopal tragedy, the Government of India enacted the Environment (Protection) Act, 1986 (EPA) under article 253 of the constitution. The purpose of the Act is to act as an "umbrella" legislation designed to provide a frame work for Central government co-ordination of the activities of various central and state authorities established under previous laws, such as Water Act & Air Act. The potential scope of the Act is broad, with "environment" defined to include water, air and land and the inter-relationships which exist among water, air and land, and human beings and other living creatures, plants, micro-organisms and property. Environment protection rules were also enacted as a corollary to this Act.

- **National Conservation Strategy and Policy Statement on Environment and Development, 1992**--This proposed some of the specific means through which the goals of an environmentally wise society could be attained.
- **Policy Statement for the Abatement of pollution, 1992**-- The objective of document was to integrate environmental considerations into decision-making at all

levels. To achieve this, the document laid down steps to be taken to prevent pollution at source, encourage, develop and apply the best available practicable technical solutions.

- **National Environment Policy, 2004 and 2006--** The principal objectives of the policy in 2004 were the conservation of critical environmental resources, intra-generational and inter-generational equity, integration of environmental concerns in economic and social development, efficiency in environmental resource use, environmental governance and enhancement of resources for environmental conservation. The NEP 2006 is intended to be a guide to action: in regulatory reform, programmes and projects for environmental conservation; and review and enactment of legislation, by agencies of the Central, State, and Local Governments. The policy also seeks to stimulate partnerships of different stakeholders, i.e. public agencies, local communities, academic and scientific institutions, the investment community, and international development partners, in harnessing their respective resources and strengths for environmental management. The dominant theme of this policy is that while conservation of environmental resources is necessary to secure livelihoods and well-being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the fact of conservation, than from degradation of the resource. The policy also seeks to stimulate partnerships of different stakeholders, i.e. public agencies, local communities, academic and scientific institutions, the investment community, and international development partners, in harnessing their respective resources and strengths for environmental management.
- **Vision Statement on Environment and Health**—the purpose of this document was to evolve a strategy of health-risk reduction arising from environment pollution would help the implementing agencies to revise the environmental and industry specific actions.

Legislative framework for waste management in India

Rules

- The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008.
- The Batteries (Management and Handling) Rules, 2001.
- The Municipal Solid Wastes (Management and Handling) Rules, 2000. The Recycled Plastics Manufacture and Usage Rules, 1999.
- The Recycled Plastics Manufacture and Usage (Amendment) Rules, 2003.
- Prohibition on the handling of Azodyes.
- The Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996
- The Rules for the Manufacture, Use, Import, Export and Storage of Hazardous micro-organisms Genetically engineered organisms or cells.
- The Rules for the Manufacture, Use, Import, Export and Storage of Hazardous micro-organisms Genetically engineered organisms or cells(Amendment).
- The Manufacture, Storage and import of Hazardous Chemical Rules, 1989.

- Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 2000. The Bio-Medical Waste (Management and Handling) Rules, 1998.
- Bio-Medical Waste (Management and Handling) (Amendment) Rules, 2003.

Notifications

- Notification on Public Liability Insurance Act.
- Fly ash in construction activities, Responsibilities of Thermal Power Plants and Specifications for use of ash-based products/responsibility of other agencies, Notification, dated 03 April, 2007.
- Recognition of the laboratories that are allowed to use of pathogenic micro organisms or genetically engineered organisms or cells for the purposes of research.
- Dumping and disposal of fly ash discharged from coal or lignite based thermal power plants on land.

The full text of these acts/notifications can be found at <http://envfor.nic.in/legis/hsm.htm>

Programmes of MoEF on reduction of waste

Apart from rules for the management of waste, MoEF also funds programmes for waste minimisation, especially in industries. Some of its programmes which target on the reduction of waste, under its Clean Technology vision are:

- **Charter on Corporate Responsibility for Environmental Protection (CREP):** The Ministry of Environment & Forest (MoEF) has launched the Charter on "Corporate Responsibility for Environmental Protection (CREP)" in March 2003 with the purpose to go beyond the compliance of regulatory norms for prevention & control of pollution through various measures including waste minimization, in-plant process control & adoption of clean technologies. The Charter has set targets concerning conservation of water, energy, recovery of chemicals, reduction in pollution, elimination of toxic pollutants, process & management of residues that are required to be disposed off in an environmentally sound manner. The Charter enlists the action points for pollution control for various categories of highly polluting industries like the tannery sector, developed of Minimal National Standards (MINAS) for rubber products manufacturing industries and prepared a comprehensive industry document on electroplating industry. A Task Force was constituted for monitoring the progress of implementation of CREP recommendations/ action points.
- **Assistance for Abatement of Pollution:** The scheme, namely, "Assistance for Abatement of Pollution", meets the need to strengthen the CPCB and SPCBs for enforcing the statutory provisions for taking up pollution abatement measures.

2.4 Key Players in the waste management stream

Kind of waste	Implementing body	Monitoring body
Bio-medical waste	State government to establish an authority for granting authorisation and implementing these rules.	SPCB

	Hospitals and all institutions generating bio-medical waste as defined in the Act are responsible for segregation, collection, transportation, safe handling and disposal as defined in the Act.	
Municipal solid waste	State government has overall responsibility for enforcement of MSW rules in metro cities and the DMs/DCs have overall responsibility for enforcement of MSW rules in other cities.	SPCB to grant/extend authorisation and monitor compliance of standards regarding ground water, ambient air, leachate quality and the compost quality including incineration standards as specified in schedules II, III and IV of municipal solid waste handling and management rules.
	Municipal authority is responsible for segregation, collection, transportation, processing and disposal of the waste according to the provisions in the municipal solid waste Rules	CPCB to prepare a consolidated annual review report on management of municipal solid wastes and forward it to Central Government along with its recommendations before the 15 th of December every year.
Recycled Plastics	The DMs/DCs of the district are responsible for enforcement of rules relating to use, collection, segregation, transportation and disposal.	SPCB has overall responsibility for enforcement of provisions of these rules
Hazardous waste	The responsibility for handling and disposal is that of the industry/factory creating the waste. The industry/factory can send the wastes for safe disposal to recyclers/re-processor or operator of a Treatment, Storage and Disposal facility authorised by SPCB.	SPCB will grant/extend authorisations to recyclers/re-processor or operator of a Treatment, Storage and Disposal facility.
		CPCB will grant authorisations, based on recommendations of SPCB
		MoEF is the nodal agency for import and export of hazardous waste.

Authorities and Agencies/ Authorities Responsibilities **Responsibility**

1	Municipal Authorities	<ul style="list-style-type: none"> i. Ensuring that municipal solid wastes to be handled as per rules. ii. Seeking authorization from State Pollution Control Board (SPCB) for setting up waste processing and disposal facility including landfills. iii. Furnishing annual report. iv. Complying with Schedule I, II, III and IV of the rules
2. (i), (ii)	State Government Secretary In-Charge of Department of Urban Development District Magistrates/ Deputy Commissioner	<p>Overall responsibility for the enforcement of the provisions of the rules in the metropolitan cities.</p> <p>Overall responsibility for the enforcement of the provisions of the rules within the territorial limits of their jurisdiction.</p>
3	Central Pollution Control Board (CPCB)	<ul style="list-style-type: none"> i. Co-ordinate with State Boards and Committees with reference to implementation and review of standards and guidelines and compilation of monitoring data. ii. Prepare consolidated annual review report on management of municipal solid wastes for forwarding it to Central Government along with its recommendations before the 15th of December every year. iii. Laying down standards on waste processing/ disposal technologies including approval of technology.
4.	State Pollution Control Board (SPCB)	<ul style="list-style-type: none"> i. Monitor the compliance of the standards regarding ground water, ambient air leachate quality and the compost quality including incineration standards as specified under Schedule II, III & IV. ii. Issuance of authorization to the municipal authority or an operator of a facility stipulating compliance criteria and standards. iii. Prepare and submit to the CPCB an annual report with regard to the implementation of the rules