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Achieving Sustainable Development through Solid Waste Management in India

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Abstract

Solid waste is the unwanted or useless solid materials generated from human activities in residential, industrial or commercial areas. It may be categorized in three ways, such as **origin** (domestic, industrial, commercial, construction or institutional); **contents** (organic material, glass, metal, plastic paper etc); and **hazard potential** (toxic, non-toxic, flammable, radioactive, infectious etc). Solid Waste Management reduces or eliminates the adverse impact on the environment & human health. A number of processes are involved in effectively managing waste for a municipality. These include monitoring, collection, transport, processing, recycling and disposal. The quantum of waste generated varies mainly due to different lifestyles, which is directly proportional to socio economic status of the urban population. According to the Press Information Bureau, India generates 62 million tonnes of waste (mixed waste containing both recyclable and non-recyclable waste) every year, with an average annual growth rate of 4.0 percent **(PIB 2016).** Urban India (about 377 million people) generates 62 million tonnes of municipal solid waste each year, of this about 43 million tonnes (70.0 per cent) is collected and 11.9 million tonnes (20.0 per cent) is treated. About 31 million tonnes (50.0 per cent) is dumped in landfill sites **(MoEF&CC and Down to earth, 2016).** According to the Associated Chambers of Commerce and Industry of India **(ASSOCHAM)** rapid economic growth and changing consumer behavior is likely to increase e-waste generation in India to 5.2 million tonnes per year by 2020. India generates nearly 530 million tonnes of C&D waste annually. This number is only going to skyrocket in the future, considering that two-thirds of the buildings that India will have in 2030 are yet to be built **(Jigyasa Watwani, 2016).** Waste management and diligent planning becomes critical for regulation of humongous solid waste being generated every day. With growing urbanization and rise of smart cities on the offing the issue of solid waste management becomes even more imperative. With this background the authors have made an attempt to examine the major impact of Solid waste management on environment with evidence and examples from Indian Economy.

Key words: Solid Waste, Waste Disposal, Municipal Solid Waste and Solid Waste management

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Introduction

India is having second largest population in the world after China with more than 1.38 billion population contributing 17.7 percent of world's total population (Official population clock). On the contrary, population density in India is 464 per Km^2 (1,202 people per mi^2). India is sharing only 5 percent of world's area accounting 2,973,190 km^2. Out of total population, 65 percent lives in rural areas, while 35 percent lives in urban areas **(World Bank, 2021 and Worldmeter, 2021).** Urban population is increasing day by day since last few decades. In modern society, industry becomes an essential part. Developing countries like India are in industrialization phase, which also contribute to urbanization. Large numbers of people are migrating towards city areas for better opportunities. In terms of GDP, India is one of the fastest growing economies in the world with 7.30 percent GDP. It is expected that by 2030 India will be growing with GDP of 10 percent. Higher GDP will result into improved living standards. Over-population, Rapid industrialization. Uncontrolled urbanization and improved living standards thereby lead to increased rate of per capita waste generation (**Abhishek Nandan et al, 2017).**

The appalling state of and challenges in municipal solid waste management (MSWM) in India is the motivation of the present study. India contributes enhanced municipal solid waste (MSW) generation and unscientific handling of MSW degrades the rural and urban environment and causes health hazards. India generates 62 million tonnes of waste every year, of which less than 60 percent is collected and around 15 percent processed. With landfills ranking third in terms of greenhouse gas emissions in India, and increasing pressure from the public, the Government of India revised the Solid Waste Management after 16 years. This paper proposes an institutional framework that will address this grave environmental and public health concern and bring about a systemic change in the sector.

Currently, 1,27,486 tons per day of municipal solid waste is being generated due to various household activities and other commercial & institutional activities **(CPCB, 2012).** Moreover As per the central pollution control board **(CPCB**) of India, the per capita waste generation has increased at an exponential rate (0.26 kg/day to 0.85 kg/day) (CPCB India, 2018). It is estimated that approximately 80.0 percent to 90.0 per cent of the municipal waste is disposed-off in landfills without proper management practices and open burning,

leading to air, water, soil pollution **(Ahluwalia and Patel, 2018).** Municipal waste and certain industrial waste have comparatively significant impact on environment. A substantial amount of these wastes is extremely dangerous to the living organisms including human beings **(Misra et al. 2005**). It may downgrade groundwater quality by leachate percolation and also cause air pollution by emission of greenhouse gases through various courses of treatment. Nowadays, E-waste and nuclear waste are waste streams which are requiring attention due to fastest growing electronics & nuclear sector. To overcome this problem, effective solid waste management must be implemented. The objectives of solid waste management are to control, collect, process, utilize and dispose of solid wastes in such an economical way which protects health of human beings and natural environment and the objectives of those served by the system.

The current status of MSWM in Indian states and important cities of India is also reported. The essential conditions for harnessing optimal benefits from the possibilities for public private partnership and challenges thereof and unnoticeable role of rag-pickers are also discussed. Municipal solid waste management (**MSWM**), a critical element towards sustainable metropolitan development, comprises segregation, storage, collection, relocation, carry-age, processing, and disposal of solid waste to minimize its adverse impact on environment. Unmanaged MSW becomes a factor for propagation of innumerable ailments (Kumar et al., **2009**). Annually, about 12 million tons of inert waste are generated in India from street sweeping and C&D waste and in the landfill sites, it occupies about one-third of total MSW. In India, MSWM is governed by Municipal Solid Waste (Management and Handling) Rules, 2000 (MSWR) and implementation of MSWR is a major concern of urban local bodies (**ULBs**) across the country.

Solid waste management practices and challenges in India

Growing urbanization and industrialization in developing countries, high population growth rates, rapidly varying waste characterization and generation patterns (**Troschinetz** and **Mihelcic, 2009)** are important factors for paying attention towards municipal solid waste management as more area will be required to accommodate waste **(Idris et al, 2004)**. Transmission of numerous ailments is caused by unmanaged municipal solid waste. Major problems in India regarding municipal solid waste management is non-segregation of waste and dumping of construction and demolition debris (C&D), plastic wastes, commercial and industrial re-fuses, and e-waste **(Buenrostro and Bocco, 2003).**

Solid waste can be defined as non-liquid material that no longer has any value to the person who is responsible for it. The words rubbish, garbage, trash, or refuse are often used as synonyms when talking about solid waste. In urban areas, solid waste is generated by domestic households, commercial and industrial enterprises, and health care and institutional activities, as well as on the streets. Street refuse contains a mixture of refuse from many sources, because streets are used as dumping grounds by all generators of waste. Where sanitation facilities are lacking and a large animal population roams the streets, street refuse contains a lot of human fecal matter and manure. Streets are also often used for extensive dumping of construction and demolition debris—attracting further dumping of solid waste.

Domestic Wastages: Recently, single-use plastics have become a global threat which is considered harmful and non-biodegradable. In cities, the generation of excess plastic waste could lead to drainage choking during the monsoon that result in urban flooding, Subsequently the micro-plastic intermixes with water polluting the rivers and oceans **(Anderson et al., 2016).** Current studies have demonstrated that the presence of micro-plastic causes disturbances in the aqua life (primarily the food chain) and ultimately leading to global warming. Consequently, reported as the primary reason for the extinction of various indigenous species on the planet Earth **(United Nations, 1992).** As per the report published in UNPD, the world produces around 300 million tonnes of plastic waste, only 9% of the generated plastic waste is recycled, 14% collected for recycling while the rest reaches the ocean annually **(Plastic Recycling: An Underperforming Sector Ripe for a Remake, 2019).** Further single use plastic items or plastic commodity intended to be used once before being disposed of or recycled. According to GOI, 2021 single use plastic items to be panned from January 1, 2022. According to **TOI, 2020** moreover 40 percent of generated wastes remains uncollected in country like India; plastic waste collection 15,564 tpd (60.0 percent of total) and uncollected plastic waste 10,376 tpd (40.0 percent of total). The uncollected plastic waste causes chocking of drainage and river systems, soil and water contamination, littering of marine ecosystems, ingestion by stray animals, and its open air burning leads to adverse impact on human health and environment **(The Times of India, 2021).**

According to the **Press Information Bureau,** India generates 62 million tonnes of waste (mixed waste containing both recyclable and non-recyclable waste) every year, with an average annual growth rate of 4 percent (PIB 2016). The generated waste can be divided

into three major categories: Organic (all kinds of biodegradable waste), dry (or recyclable waste) and biomedical (or sanitary and hazardous waste).

In India, MSWM is governed by MSWR. However, majority of ULBs do not have appropriate action plans for execution and enactment of the MSWR **(CPCB Report, 2013).** Unfortunately, no city in India can claim 100 percent segregation of waste at dwelling unit and on an average only 70 percent waste collection is observed, while the remaining 30 percent is again mixed up and lost in the urban environment. Out of total waste collected, only 12.45 percent waste is scientifically processed and rest is disposed in open dumps **(CPCB Report, 2013).** Existing and future land requirement for disposal of MSW along with growth in population and MSW generation. Critical examination of important parameters of MSWM practice with respect to Indian Scenario is delineated below Segregation, Collection, Reuse/recycle, Transportation, and Disposal. Further Solid waste can be classified in many ways according to its source, composition, phase, treatment required etc. Table - 1 describes type of wastes on basis of its source. It includes residential, municipal, mining, agricultural, industrial etc.

Table - 1

Classification of Solid Wastes

Sl.NO	Source	Typical Waste Generators /Type of Solid Waste
1	Domestic waste	Household waste- kitchen, house cleaning, old papers, packing bottles, crockery wares, furnishing materials, garden trimmings etc.
2	Commercial Waste	Waste generated at business premises , shops , office ,markets, department stores, organic, inorganic ,chemically reactive and hazardous waste
3	Institutional wastes	Schools, colleges, hospitals , large hotels and restaurants , markets selling vegetables , fruits , fish, etc
4	Industrial /Trade waste	Waste generated through manufacturing and material processing
5	Electronic Wastes	Waste from used electronics devices
6	Debris or construction Rejects	Comprises of earth , bricks , stones , wooden logs
7	Bio medical wastes	Animal waste such as animal tissue , organs , body parts ,carcasses ,fluid , blood , discharge from hospitals ,animal houses
8	Hazardous wastes	Hazardous in nature for human health and the environment , as in the Hazardous waste management rues 1989

Source: CPHEEO, 2000- Manual on Municipal Solid Waste Management", Ministry of Urban Development,

Composition and uniqueness of Indian municipal solid waste

In general terms, solid waste can be defined as waste not transported by water; that has been rejected for further use. It includes industrial, mining, municipal and agricultural wastes. It mainly consists of a large organic matter, ash and fine earth, paper and plastic, glass and metals (Sharholy et al. 2007). Composition of solid waste however varies depending on various factors such as weather, living standards etc.

Following major categories of waste are generally found in MSW of India:

- ✓ **Biodegradable Waste:** Food and kitchen waste, green waste (vegetables, flowers, leaves, fruits) and paper.
- ✓ **Recyclable Material:** Paper, glass, bottles, cans, metals, certain plastics, etc.
- ✓ **Inert Waste Matter:** C&D, dirt, debris.
- ✓ **Composite waste:** Waste clothing, Tetra packs, waste plastics such as toys.
- ✓ **Domestic Hazardous Waste** (also called "household hazardous waste") and toxic waste:

Waste Amount and Composition: Typically, domestic waste from industrial countries has a high content of packaging made of paper, plastic, glass, and metal, so the waste has low density. In many developing countries, domestic waste contains a large proportion of inert materials, such as sand, ash, dust, and stones, and has high moisture levels because of the high usage of fresh fruit and vegetables. These factors make the waste very dense (high weight per unit volume). Vehicles and systems that operate well with low-density wastes in industrial countries are not suitable or reliable for heavy-density wastes. The combination of the extra weight, the abrasiveness of sand, and the corrosiveness caused by the water content can lead to very rapid deterioration of equipment. Waste that contains a high proportion of moisture or is mostly inert material is not suitable for incineration, ruling out one treatment option. Recycling or salvaging operations often reduce the proportion of combustible paper and plastic in waste before it reaches the treatment stage, further reducing its suitability for incineration.

Waste medicine, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, and shoe polish. MSW in India has approximate 40–60 percent compostable, 30–50 percent inert waste and 10 percent to 30 percent recyclable. Analysis carried out by NEERI reveals that in totality Indian waste consists of Nitrogen content (0.64 ± 0.8) percent, Phosphorus (0.67 ± 0.15) percent, Potassium (0.68 ± 0.15) percent, and C/N ration (26 ± 5) percent. Change in the physical and chemical composition of Indian MSW with time is shown in Table below.

Table – 2

Change in composition of municipal solid waste (in percent)

Year	biodegradables	Paper	Plastic/rubber	Metal	Glass	Inert
1996-97	42.21	3.63	0.60	0.49	0.60	45.13
2005-06	47.43	8.13	9.22	0.50	1.01	25.16
2011-12	42.51	9.63	10.11	0.63	0.96	17.00

Source: Planning Commission Report, 2014

According to CPCB report, municipal solid waste generation in year 2010-11 is about 1, 27,486 Tons per day. The same was about 1, 00,000 TPD (Tons Per day) in year 2000 as per report (May, 2000) of Ministry of Urban Development (MoUD), Government of India. During 2004-05, CPCB conducted survey through NEERI in 59 cities and estimated 39,031 TPD MSW generations. In year 2010-11, survey was again conducted by CIPET at the instance of CPCB and estimated 50.592 MSW generations. As the data only accounts for proper scientific waste disposal, this amount can be very large in actuality. Per capita waste generation varies between 0.2 to 0.6 kg per capita per day depending upon population size, living standards etc. It is estimated to increase at 1.33 percent annually. Industrial sector generates 100 million tons/year of no-hazardous solid waste consisting coal ash more than 70 million tons/year. About 8 million tons/year of hazardous waste is generated in each year, out of 4.8 which million tons is recyclable. As a matter of fact, people still throw household waste without following proper waste management channel, few industries dumping their wastes illegally and lack of awareness is still there related to agricultural waste disposal. Rate of waste generation is increasing continuously due to increasing population, industrialization, rapid urbanization and change in living standards. It should be noted that the significant amount of waste generation is contributed by metropolitan cities and other industrial areas. Nowadays, Electronics industry is one of those sectors which are rapidly growing in the world. Extensive use of electronic items and their short life causes the disastrous proportions of E-waste. Apart from these, nuclear waste is of prior importance due to its adverse environment impacts.

The term municipal solid waste refers to solid waste from houses, streets and public places, shops, offices, and hospitals. Management of these types of waste is most often the

responsibility of municipal or other governmental authorities. Although solid waste from industrial processes is generally not considered municipal waste, it nevertheless needs to be taken into account when dealing with solid waste because it often ends up in the MSW stream. A typical waste management system in a low- or middle-income country includes the following elements:

- ✓ Waste generation and storage
- ✓ Segregation, reuse, and recycling at the household level
- ✓ Primary waste collection and transport to a transfer station or community bin
- ✓ Street sweeping and cleansing of public places
- ✓ Management of the transfer station or community bin
- ✓ Secondary collection and transport to the waste disposal site
- ✓ Waste disposal in landfills
- ✓ Collection, transport, and treatment of recyclables at all points on the solid waste pathway (collection, storage, transport, and disposal)

Waste Segregation

Waste segregation is the biggest obstacle for effective solid waste management. It is common in developed countries like U.S., Europe and Japan; but countries like India most often collect MSW in a mixed form. It is mainly because of lack of public awareness and advancements in source separation techniques. However, paper and certain type of plastics are separately collected at source level by waste pickers or waste buyers. Source separation increases recycling efficiency. It also improves performance of waste treatment units due to good quality of feed and lesser amount of impurities.

Reduce: The term ‘Reduce’ can be defined as a reduction in the amount and/or toxicity of waste entering the waste stream. Use of green elements as raw materials, extension of product life cycle, optimum process design, reducing energy and heat losses, replacing raw materials by lighter material can help to reduce the amount of waste generation. ‘Reduce’ is the top ranking component of solid waste management hierarchy because it represents most effective means of reducing economical costs and environmental impacts associated with handling waste. Life cycle assessment is very important for effective source reduction of waste (**Abhishek Nandan et al, 2017**)

Reuse: The term 'Reuse' means usage (or utilization) of a product in the same application for which it was originally used. For example, a plastic bag can carry groceries home from the market over and over again, a tin can be used as a multi-purpose container. A product can also be reused for some other purpose, such as occurs when glass jars are reused in a workshop to hold small objects such as screws or nails. Remanufacturing is often used in this regard which means restoring a product to like new condition. It involves disassembling the product, cleaning and refurbishing the useful parts and stocking those parts in inventory. While repair means only those parts that have failed are replaced. (**Abhishek Nandan et al, 2017**).

Recycling: The recovery of materials for recycling is given second highest priority in the solid waste management hierarchy after source reduction. 'Recycling' simply means use of waste as raw materials for other products. It includes collection and separation of recyclables and processing them to useful raw materials for other products. It can be classified as pre consumer and postconsumer recyclable materials. Pre consumer materials consist of scrap that is recycled back into manufacturing process without having been turned into a useful product (**Abhishek Nandan et al, 2017**).

Environmental Impacts of Wastes

Solid waste management in India faces similar challenges like inadequate segregation of waste at source, and improper disposal in land fill site leading to serious environmental challenges.

E-Wastes: The e-waste contains a number of toxic components that can cause serious damage to environment and human and animal health if not properly discarded in an environmentally sound manner. Effects of some of the chemicals found in e-waste on human health are given below:

Brominates flame retardants: Brominates flame retardants (BFRs) have routinely been added to consumer products for several decades in a successful effort to reduce fire related injury and property damage. Recently, concern for this emerging class of chemicals has risen because of the occurrence of several classes of BFRs in the environment and in human biota. The widespread production and use of BFRs; strong evidence of increasing contamination of the environment, wildlife, and people; and limited knowledge of potential

effects heighten the importance of identifying emerging issues associated with the use of BFRs. These do not decompose easily in the environment, and long term exposure can cause impaired memory function and learning. Pregnant women exposed to brominates flame retardants have been shown to give birth to babies with behavioral problems as it interferes with estrogen and thyroid functioning.

Lead: Lead is a naturally-occurring element that can be harmful to humans when ingested or inhaled, particularly to children under the age of six. Found in most computer monitors and televisions, lead exposure leads to intellectual impairment in children and serious damages to human reproductive systems, the nervous system and blood. Lead poisoning can cause a number of adverse human health effects, but is particularly detrimental to the neurological development of children.

Cadmium: The kidney is the critical target organ for the general population as well as for occupationally exposed populations. Cadmium is known to accumulate in the human kidney for a relatively long time, from 20 to 30 years, and, at high doses, is also known to produce health effects on the respiratory system and has been associated with bone disease. Found in rechargeable batteries for laptop computer and other electronic devices, it can cause damage to kidneys and bones. Cadmium can be bio-accumulate in the environment and is extremely toxic to humans, in particular adversely affecting kidneys and bones.

Mercury: Elemental and methyl mercury are toxic to the central and peripheral nervous systems. The inhalation of mercury vapor can produce harmful effects on the nervous, digestive and immune systems, lungs and kidneys, and may be fatal. The inorganic salts of mercury are corrosive to the skin, eyes and gastrointestinal tract, and may induce kidney toxicity if ingested. Neurological and behavioral disorders may be observed after inhalation, ingestion or dermal exposure of different mercury compounds. Symptoms include tremors, insomnia, memory loss, neuromuscular effects, headaches and cognitive and motor dysfunction. Kidney effects have been reported, ranging from increased protein in the urine to kidney failure. Mercury (Hg), which is used in lighting devices in flat screen monitors and televisions, can cause damage to the breast milk.

Hexavalent Chromium Compounds: Hexavalent chromium is a toxic form of the element chromium. Hexavalent chromium compounds are man-made and widely used in

many different industries. A known carcinogen, these are used in the creation of metal housing which are typical of many electronic products. It can cause lung cancer, irritation or damage to the nose, throat, and lung (respiratory tract), irritation or damage to the eyes and skin etc.

Plastic compounds: Poly vinyl chloride (PVC) cabling is used for printed circuit boards, connectors, plastic covers and cables. When burnt or land-filled, these PVCs release dioxins that have harmful effects on human reproductive and immune systems.

Municipal Solid Wastes

Municipal Solid wastes from urban centers mixing up with ground water courses create potential risks to human health. There is specific danger of concentration of heavy metals in the food chain, a problem that illustrates the relationship between municipal solid wastes and liquid industrial effluents containing heavy metals discharged to a drainage/sewerage system and /or open dumping sites of municipal solid wastes and the wastes discharged thereby maintains a vicious cycle including these some other types of effects are as follows:

- Chemical poisoning through chemical inhalation
- Uncollected waste can obstruct the storm
- Water runoff resulting in flood
- Low birth weight
- Cancer
- Congenital malformations
- Neurological disease
- Nausea and vomiting
- Mercury toxicity from eating fish with high levels of mercury
- Plastic found in oceans ingested by birds
- Resulted in high algal population in rivers and sea
- Degrades water and soil quality

A major environmental concern is gas release by decomposing garbage. Methane is a by-product of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amounts of moisture. Methane concentrations can reach up to 50 percent of the composition of landfill gas at maximum anaerobic decomposition. Liquid leachate

management varies throughout the landfills. Leachate poses a threat to local surface and ground water systems.

Barriers and challenges to improved waste management in India

The current status of SWM in India is poor because the best and most appropriate methods from waste collection to disposal are not being used. There is a lack of training in SWM and the availability of qualified waste management professionals is limited. There is also a lack of accountability in current SWM systems throughout India. Municipal authorities are responsible for managing MSW in India but have budgets that are insufficient to cover the costs associated with developing proper waste collection, storage, treatment and disposal. The lack of strategic MSW plans, waste collection/segregation and a government finance regulatory framework are major barriers to achieving effective SWM in India. Limited environmental awareness combined with low motivation has inhibited innovation and the adoption of new technologies that could transform waste management in India. Public attitudes to waste are also a major barrier to improving SWM in India.

Challenges

- ✓ Awareness to enhance segregation
- ✓ Characterization of municipal solid waste
- ✓ Urbanization and lack of appropriate level funding
- ✓ Implementation of rules at ground level
- ✓ Financial auditing and work study
- ✓ Resistance for notification of new landfill site
- ✓ Lack of coordination among Centre and State
- ✓ Appropriate technological solution and involving PPP
- ✓ Failure of waste-to-energy projects
- ✓ Involvement of organized sector

The solid waste management in India faces similar challenges as faced in many states (cities) – including, inadequate segregation of waste at source, and improper disposal in land fill site leading to serious environmental challenges. In the midst of growing despair on solid waste management, the case of some economists and environmentalist states and provides optimism that if properly addressed with people's involvement these

issues can be solved with considerable ease. Recommendations applicable to waste management in India include:

- ✓ State and central governments should make the segregation of wastes mandatory and municipalities could be authorized to levy fines if segregated waste is not made available to the municipalities for collection;
- ✓ Waste processing should be made mandatory and sufficient funding should be provided by MoEF/MoUD to set up waste processing infrastructure/technology in each municipality;
- ✓ Existing dumpsites should be made more sanitary and aesthetic, dumpsites in residential areas and near water sources/ water bodies should be closed down and dumpsites should be periodically monitored to prevent environmental contamination;
- ✓ Each municipality should identify land for setting up of landfills on a priority basis and land filling should be restricted to non-biodegradable/inorganic waste;
- ✓ Both existing and new hospitals should have a treatment/disposal facility or join a common treatment facility, failing which they should not be allowed to continue their operations;
- ✓ Surprise checks should be conducted to verify vendors' compliance with plastic waste rules;
- ✓ PCB should maintain a database of manufacturers of plastic carry bags/containers to ensure that manufacture of the same does not occur without prior consent.
- ✓ In addition to the above recommendations, there is an overall need for better monitoring by the State PCB of waste disposal facilities like compost plants, incinerators, dumping grounds etc. For this purpose the state government should make provisions in the budget for waste management activities and moreover the state government and PCB should assess their manpower requirements and accordingly hire staff dedicated to the Implementation and monitoring of waste management activities**.**

Policy legislation and Initiatives

Institutional issues include current and anticipated legislation and the extent to which laws are enforced. Standards and restrictions may limit the technological options that can be considered. Government policy on the role of the private sector (formal and

informal) should also be taken into account. The strength and concerns of trade unions can also have an important influence on what can be done.

The Ministry of Environment and Forests (MoEF) is taking care of the issues related to solid waste management together with Central and State Pollution Control Boards. There are various rules framed under Environment Protection Act - 1986 for improving management of solid waste. SWM falls under state list as it is considered as public health and sanitation as per Indian Constitution. Due to its local nature, SWM is the responsibility of Urban Local Bodies (ULBs) (European Business and Technology Centre).

- ✓ Environment Protection Act – 1986
- ✓ Hazardous Waste Management and Handling Rules – 1989
- ✓ Manufacturing, Storage and Transportation of Hazardous Waste Rules – 1989
- ✓ Bio-Medical Waste Management and Handling Rules – 1998
- ✓ Municipal Solid Waste Management and Handling Rules – 2000
- ✓ Plastic Waste (Management and Handling) Rules – 2011
- ✓ E-Waste (Management and Handling) Rules – 2011

Conclusion

Population growth and particularly the development of megacities are making SWM in India a major problem. The current situation is that India relies on inadequate waste infrastructure, the informal sector and waste dumping. There are major issues associated with public participation in waste management and there is generally a lack of responsibility towards waste in the community. There is a need to cultivate community awareness and change the attitude of people towards waste, as this is fundamental to developing proper and sustainable waste management systems. The waste should be treated as resource and formal recycling sector/industries be developed to recycle non-biodegradable recyclable component from the waste thereby providing employment to rag-pickers and absorb them in mainstream. Also a policy, fiscal intensive and development of quality standard for reuse and recycle of construction and demolition (CD) waste be developed and notified so that producers dispose/reuse it as per guidelines, thereby reducing burden on landfill.

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