

Waste Management: A wasteful exercise?

(A comparative study of various states in India)

Neha Mishra¹

Abstract

Talk of Municipal Solid Waste Management (MSWM) and there appears the vision of unkempt people clearing up garbage from haphazard dumping spots on the streets of a typical Indian city. In the news, are items about pollution caused by wastes being dumped illegally in green forest areas or lakes making them unfit for use. Is it that as a nation, we are unable to manage a growing civic issue which is only be exacerbated by rapid urbanisation? There are laws and rules governing pollution and waste management on paper but implementation and management of the ground realities are still not being coordinated and managed well. The issue is a ticking environmental time bomb and need of the hour is to set in place a hierarchical structure for evolving and fine tuning the ecosystem that can manage MSWM in general and plastics waste in specific; that includes the support of contemporary scientific processes and technologies for managing waste and ensuring that the right accountabilities and responsibilities are assigned to end users, manufacturers of goods and services, central and state executive ministries as also the governing institutions along with effective governance and implementation models.

¹ Visiting Faculty, M.S. Ramaiah College of Law ,Bangalore

Municipal Solid Waste Management in India

In the next decade, urban India will generate a total of 920 million tons of municipal solid waste that needs to be properly managed in order to avoid further deterioration of public health, air, water and land resources, and the quality of life in Indian cities. In a “business as usual” scenario, India will not be able to dispose these wastes properly.²

Introductory observations:

India is the second largest populous country in the world and like other nations faces the challenges associated with rapid urbanisation and modernisation adversely impacting the environment with the generation of Municipal Solid Wastes (MSW). Also, the proliferating use of plastics in mass consumption consumer goods even today- much after the Supreme Court’s direction against the use of plastics for the same, has led to an explosion in the issues relating to waste arising out of this material. ‘It is estimated that 4-9% by weight of municipal solid waste is plastic. As a source of pollution, it contributes 16% of the chlorine in the environment and is known to have 54 carcinogens. Irresponsible burning of plastic bags generates toxic gases such as phosgene, carbon monoxide, sulphur dioxide, nitrogen oxide and dioxin.³

While there are laws governing MSW, these tend to be focused narrowly on specific compliance areas, and lesser on proactive concepts that can reduce ‘waste at source’ and involve all relevant stakeholders. In its report of September 2008, the Comptroller and Auditor General (CAG) of India observed the inadequate approach to MSWM, namely the

²RanjithKharvelAnnepu, *Sustainable Solid Waste Management in India, Executive Summary*, Waste-to-Energy Research and Technology Council (WTERTC), Columbia University, 2012, pp.3

³Dr.PawanSikka, *Plastic Waste Management in India*, Introduction, Department of Science and Technology, New Delhi, p.1.

lack of proper storage of waste, non-existence of waste processing facilities and that existing landfill sites are insufficient and follow non-compliant practices with open dumping of waste leading to pollution of ground water making it unfit for human consumption.

Where does India stand on managing solid and plastic wastes? As we examine the details in the sections that follow, a very depressing state of affairs emerges.

LEGAL INITIATIVES AND THEIR EFFICIENCY

The underlying laws got triggered first by the decisions taken at the United Nations Conference on the Human Environment held at Stockholm in June 1972, for protection and improvement of the environment and prevent of hazards to the citizens, other living creatures, plants and property. The result was the enactment of The Environment (Protection) Act, 1986, the umbrella act which empowers the Ministry of Environments and Forests (MoEF) to monitor and manage activities that have a detrimental impact on the environment. In response to public interest litigation⁴ on solid waste management in the Supreme Court, and a subsequent report by an expert committee setup as directed by the Court, the MoEF promulgated the Solid Waste Rules 2000, applicable to all municipal authorities for collection, segregation, storage, transporting, processing and disposal of municipal solid wastes. Other subsidiary acts such as Water (Prevention and Control of Pollution) Act, 1974, Water (Prevention and Control of Pollution) Cess Rules, 1978 were also enacted. Likewise, when there was greater public and international attention to the hazardous effects of plastics, the Plastic Waste Management Rules 2011, for recycling, recovery or disposal of plastic wastes in general and plastics carry bags in specific.

The problem that underlies even with the present laws and rules in place is that the present legislation have loopholes which are twisted and turned or even ignored as the definition clause doesn't do justice to the extent and scope of the waste generated by our so called attempts at '*Sustainable Development*'. For example, these rules do not cover other plastic products like PVC chappals, PET bottles and miscellaneous broken plastic articles, which are also a source of pollution and environmental hazard. Specific states, namely Himachal

⁴Almitra Patel and another, *Writ Petition No. 888*, Supreme Court, 1996

Pradesh and Haryana, have introduced legislation in regard to these items.⁵ Other states which have followed suit are Goa, Jammu and Kashmir and Maharashtra. Recycled Plastics Manufacture and Usage Rules, 1999 (as amended in 2003), prohibit the use of recycled plastic bags for storing, carrying, dispensing or packaging food stuff. The Bureau of Indian standards has issued guidelines for recycling of plastics including code of practices for collection, sorting and specifications of mass use plastic items such as piping, storage tanks, packaged food articles etc. There are additional 'directives' of the 'Prevention of Food Adulteration Department' of the Government of India relating to use of food grade plastics by outlets selling or serving food while using plastics.⁶ But what we have not seen till now is the '*engagement and responsibility assigned to producers of plastics for the entire life cycle of the material as part of Extended Producers Responsibility (EPR)*'.⁷

Government of India (GOI) has recommended adoption of different technologies, which include bio-methanation, gasification, pyrolysis, plasma gasification, refuse derived fuel (RDF), waste-to-energy combustion (WTE), sanitary landfills (SLF)- but practicability of these techniques seeping in the grass root level seems bleak, without rigorous operations planning and maintenance systems.

The question is, do we have a system that can work? The MSW 2000 rules provide a blueprint for disposal of waste, by providing for door step collection of waste, its segregation into organic/inorganic and dry waste and its disposal. Waste disposal standards for composting, treating leachates and incineration and emission limits for air and water are also covered.⁸ State governments and local municipal authorities were expected to make use of these guidelines to develop and implement their management processes and infrastructure for MSWM.⁹ Municipal authorities were required to meet the deadlines in Schedule I (by 2003) of the rules and follow the compliance criteria and procedure laid down in Schedule II.¹⁰ State pollution boards were to provide the approval governance for waste disposal and processing facilities and deliver annual reports for compliance. In addition, the Central Pollution Control Board (CPCB) is expected to coordinate the implementation of rules by the

⁵*Non bio-degradable garbage (control) Act, 1995*, Himachal Pradesh Government.

⁶*Section 49(5), Conditions for Sale*, Prevention of Food Adulteration Rules, 1955, New Delhi.

⁷*Clause 3(g), Definitions, Plastics Waste Management Rules, 2011*, Notification, Ministry of Environment and Forests, New Delhi, February 4, 2011.

⁸*Sec.4, Responsibility of municipal authority, Solid Waste Rules, 2000*, Ministry of Environment and Forests, Notification, New Delhi, 2000.

⁹*Ibid, Sec.5, Responsibility of State Government and the Union territory Administrations.*

¹⁰*Ibid, Schedule I- Implementation Schedule; II – Management of Municipal Wastes.*

State Pollution Boards (SPCB)¹¹ while the Urban development departments of the States are to ensure effectiveness of implementation of rules. Even with the multiple strata of enforcement and monitoring, the effectiveness in the municipal waste management is yet to be seen. One major reason of such failure- seems to be the lack of coordination among these authorities.

Another major concern of about the above laws and directives is that they are focused on waste disposal and keep a blind-eye to a proactive approach to waste management guided by the 3R or 5R principles of – Reduce, Reuse, Recycle (3R's), Research and Recovery (5R's).¹²

All of the above laws and mandates appear to give a false sense of security that we have a good framework to manage MSWM in place. As we will see, a major lacunae in the current laws and rules is that they do not clearly identify polluters and do not hold them effectively responsible for illegal waste dumping by creating a deterrence through the polluter pays principle. All types of wastes and their handling are also not clearly dealt with (examples like electrical, packaging, e-waste etc). Apart from this, the implementation of these laws remains lax and haphazard.

Case Studies on Waste management – Inadequate implementation

Nagpur was among the few cities which successfully did a model implementation of the MSW 2000 rules, wherein, doorstep collection of solid wastes from residential and commercial sources (using a “SwachhaDoot” concept) is undertaken and the same is disposed off through a public private partnership which transports and recycles/disposes of wastes. The partnership has been in place for 3 years and is one example of reasonable planning and positive results, providing employment and other benefits.¹³

On the other hand the recent cases in **Bangalore** are proving shameful extremes of the inability of the supervising authorities to check the waste management in the city. Few examples are Mandur and Laksmipura Lake where indiscriminate dumping of industrial and biomedical wastes is having an adverse impact to the local populace there due to ground,

¹¹Sec 6, *Responsibilities of Central Pollution Board and the State Board or Committees*, *Supra n.11*.

¹²Dr, Manju Raina, *3R's for a Green Economy*, Ministry of Environment and Forests, New Delhi, October, 2010.

¹³Dr Vivek Agrawal, *Sustainable Waste Management; Case Study of Nagpur India*, *Abstract*, 2005, pp.1.

water and air pollution¹⁴. This is an example of lax monitoring or inspection and enforcement by the municipal corporation.

In the case of **Mumbai Municipal Corporation**, while they have MSWM practices aligned to the MSWM rules 2000,¹⁵ the challenge there is the sheer quantum of wastes and its handling. Because of improper systems for segregation of waste collected from different areas and delays in transporting, often, waste overflows into drains clogging them, resulting in devastating effects to the extent of drains getting clogged and adding onto the causes of city flooding, one of which we all witnessed in July 2005¹⁶. They also have the issues of inadequate planning for capacity in identification of new landfill sites which is further complicated by unauthorized settlements that spring up on any open land space. Pilot projects like 3R based Advanced Locality Management program have been started to engage local communities¹⁷, but their long term sustenance needs to be established. Mumbai's case is the problem of every large metro city facing the impact of a burgeoning population and deficiencies in management of MSWM on a large scale.

Gauhati Municipal Corporation (GMC), represents what is happening in most of the country, does not have any systems for transportation and disposal as mandated through the MSW Rules 2000.¹⁸ Once again the same is highlighted by the anecdotal situation in Bangalore city, where the **Bruhat Bangalore MahanagaraPalike (BBMP)**, is unable to dispose waste properly and in consonance with the existing rules. Such inaction on the part of authority is facing opposition from villages affected by the haphazard and badly planned existing landfills at Mandur, Mavallipuraas such unorganised dumping has badly polluted the environment (air, land, groundwater) of the areas surrounding the landfills and the livelihood of settlements in the area leading to massive protests. The latter land fill has been banned for any further dumping by the State Pollution Control Board. This is also made worse as most of the waste is unsegregated increasing the hazard impact of toxic pollution in the environment. The planned bio mechanical waste treatment plants have also not been setup¹⁹. This reflects

¹⁴Indian Environmental Portal, August 2012, available at

<http://www.indiaenvironmentportal.org.in/news/medical-waste-choking-lakshmipura-lake>

¹⁵Mahadevia, Pharate, Mistry, *New Practices of Waste Management – Case Mumbai, Section 1*, School of Planning, CEPT University, Kasturbhai Lalbhai Campus, Ahmedabad, December 2005, pp.2.

¹⁶Fact Finding Committee on Mumbai Floods, *Report*, Section 10.1.1(2), vol. I, 2006, p.248.

¹⁷Ibid

¹⁸Dr Daisy Das and Dr Ratul Mahanta, *Municipal Solid Waste Management Study, Gauhati City*, Deptt of Economics, Gauhati University, Assam, Deptt of Economics, North Eastern Hill University, Nov 2011, p. 1

¹⁹Praja, *Garbage Cities Garbage Mismanagement*, available at

<http://praja.in/en/blog/psaram42/2012/08/23/garbage-cities-garbage-mismanagement>

lack of a scientific and viable approach to waste disposal and engagement of the affected communities. The BBMP corporators were in the news in April 2012, where they were demanding tickets for the prestigious Indian Premier League cricket tournament, and stopped disposal of waste for the stadiums where the matches were played. This reflects the poor commitment and accountability to address basic civic issues by the elected representatives.

Consider on the other side, the use of apparently sound technologies for processing MSW. The projects that have been implemented have not succeeded as the suitability and the requirements for the success of such initiatives in Indian conditions were not studied well enough. Two key examples to reiterate the above mentioned:

Aerobic Composting (Mechanical Biological Treatment): With more than MBT plants in the country, a majority of them face problems of toxic and heavy metal content of the compost produced by them being way above the permissible levels and these can therefore enter the human food chain. Why does this happen? Because segregation of organic waste from other non-recyclable inorganic wastes is not done.²⁰

Refuse Derived Fuel (RDF) and Waste-to-Energy (WTE): These plants produce electricity, but have had to shut down as the sourcing of segregated organic waste was ill conceived and unplanned leading to shortage of the raw materials needed to run them.²¹

There are several other examples of studies focusing on the inadequacy if implementation of good MSWM practices leaves.²² Landfill sites not being designed and approved by State Pollution boards, leads to the health hazard of toxic chemicals getting leached and polluting ground water irreversibly and affecting the local populace.²³ Although some cities have achieved some progress in MSWM as is the case of Nagpur and Mumbai, most cities and towns have not even initiated measures²⁴.

²⁰RanjithKharvelAnnepu, *Sustainable Solid Waste Management in India, Introduction*, Waste-to-Energy Research and Technology Council (WTER), 2012, Columbia University, p.25.

²¹Ibid, *Introduction*, p.26.

²²Da Zhu, *Improving Municipal Solid Waste Management in India, A Source Book for Policy Makers and Practitioners*, The World Bank, Washington DC, 2008, p14.

²³*Guidance Note: Municipal Solid Waste Management on a Regional Basis*. Ministry of Urban Development, Government of India, p10, available at http://www.urbanindia.nic.in/programme/uwss/slb/urban_sanitation.pdf

²⁴*Position Paper on the Solid Waste Management Sector in India, Executive Summary*, Public Private Partnerships in India, Department of Economic Affairs, Ministry of Finance, Government of India, 2009, p1. available at http://www.indiaenvironmentportal.org.in/files/ppp_position_paper_solid_waste_mgmt.pdf

PLASTICS RECYCLING – ZERO ATTENTION?

If we turn our attention to Plastics, the situation is even more worrisome as there are no sound systems and processes governing Plastics recycling. The CAG report of 2008, referred earlier is the only authoritative source of data on recyclers of plastic waste and the processes that they are following.

- There is no waste disposal capacity planning for the rising volume of plastic wastes, given that 20% of the same are not recyclable
- Substandard plastics production and most manufacturers in the unorganised sector which is less regulated.
- Plastic recycling is carried out in small unauthorized units in a completely unregulated manner with processors using poor quality dyes and plasticisers which are carcinogenic leading to resulting highly contaminated hazardous plastic products.
 - o Recycling is limited to thermo plastics only and very little to multi layered laminated and thermoset plastics.
- Unscientific disposal of plastic wastes in landfills will cause such lands to be infertile apart from toxic leachates polluting ground water.
- Indiscriminate littering of plastics waste with no regulatory oversight.
- There is no focus on assigning responsibility and accountability at the implementation levels as agencies involved work in isolation given that each state has adopted different mechanisms for dealing with plastic waste management.²⁵

MSWM: THE GROWING LOGJAM!

Most advanced countries have adopted the 3R/5R approach mentioned earlier. The underlying thinking is reduction of waste at source and re-cycle and re-use as much as possible. Such countries have adopted measures, which that enable newer eco -friendly practices in packaging and storage and reduction/avoidance of usage of plastics, substitution by bio-degradabale packaging and alternative processes for distribution of goods used by the mass population. Compulsory segregation of wastes by type of materials such as glass, metals, paper and so on is the norm. Combustible materials are recycled for electricity

²⁵Dr, Manju Raina, *3R's for a Green Economy*, Ministry of Environment and Forests, New Delhi, October, 2010.

production through combustion or they along with organic materials are composted to manure. Likewise, paper wastes, tetrapaks, packaging boards, metal containers, bottles etc. are reused. In Japan, waste is seen as a resource rather than a disposal issue. Korea's waste management policy seeks to provide a clean environment to its people. South Africa's waste management policy is focused on waste reduction at source and maximise recycling/reuse or recovery. Ireland is focused on "integrated waste management", Philippines defines it as a comprehensive ecological program that protects the public health and environment, while in Finland, waste prevention and reducing the harmful effects of waste is the focus. All of these countries have targets of 35-75% recycling of wastes.²⁶

An approach to small scale recycling is shown in the picture alongside.

What are we doing in India? The focus on segregation at source is not mandated appropriately, so much of the wastes do not get re-used or recycled, and even if it does, the pollution effects are high. And in the case of plastic wastes, while 80% of the waste is recyclable, being thermoplastic, the 20% that is not recyclable poses a bigger issue. Our current legal framework does not have an integrated and holistic focus on a systematic and uniform practice so that waste reduction can be achieved at the point of origination and managed better through its life cycle.

Consider the **Environmental impact and Health Hazard**sof improper waste disposal:

- Filthy and unhygienic pollution of public spaces like roads, parks and other open spaces.
- Choked drains from overflow garbage leading to flooding during monsoons
- Health hazards by encouraging the growth of the rodent population leading to potential epidemics like the Surat bubonic plague²⁷.
- Leaching of toxic chemicals and heavy metals polluting ground water aquifers making them unfit for human consumption.
- Indiscriminate burning of waste leading to air pollution and toxic gases in specific, in the case of plastics.²⁸

²⁶Comptroller and Auditor General, *Performance Audit Report on Management of Waste in India*(Report PA14 of 2008), New Delhi, September 2008,

²⁷Project Notes, Innovative Approaches to Solid Waste Management in India, Indo-US Financial Institutions Reform and Expansion Project (FIRE D), Chetan Vaidya, Private Sector Participation in Solid Waste Collection and Transportation, Note 15, Feb 1999, available online at <http://www.niua.org/indiaurbaninfo/fire-D/ProjectNo.15.pdf>

- Mixing plastics with soil can alter the ground charging imperviousness of lands and making them infertile.

LAW IN PRACTICE v. LAW ON PAPER

Even for the laws that exist at present, there are serious lacunae in the way these are implemented. Let's look at the major points that the laws require and their current status:

- Regular collection of waste by municipalities is yet to be achieved leading to accumulation, health hazards, choking of sewerage and possible flooding during rains.
- Once collected, waste needs to be segregated into recyclable (dry/wet, organic/inorganic) and non-recyclable components. This is not done systematically or not at all, leading to serious environment and health issues in areas surrounding the landfills where waste is finally disposed off.
- Collected waste needs to be transported in closed containerised trucks. In most cases, waste is transported in open trucks that scatter waste, which is the reality.
- Waste processing facilities that are mandated don't exist in most cases, and where they do, are not run with sound operational and maintenance processes in place, leading to the facility shutting down or running sub optimally.
- Landfills, an important component of the cycle in waste management, are not set up as specified, leading to open dumping of waste. And where they are setup, are overflowing as no thought to forecasting the capacity required and therefore provide for new landfills locations. Many of these also do not have Pollution Control Board approvals as required by the MSW rules.
- MoEF is the nodal agency to formulate the laws but has no responsibilities to coordinate and ensure that the laws are in fact being implemented as there is no governance model for the same that clearly identifies roles and responsibilities of different agencies in the waste disposal life cycle.
- Compliance for Plastics waste management rules is a herculean task and it is not practically possible for Deputy Commissioners and District Magistrates to verify that vendors use carry bags or containers as specified or use recycled plastics for storing

²⁸Dr AB Harapanahalli, *Plastic Waste Management*, Ministry of Environment and Forests, New Delhi, available at <http://www.slideshare.net/indiawaterportal/plastic-waste-management-by-dr-ab-harapanahalli-director-ministry-of-environment-forests-regional-office>

and selling food stuffs. Also whether the recycling of plastics wastes is done as per Bureau of Indian Standards. This is further made difficult as there is no database for manufacturers and recyclers that can be used to verify whether they have authorisations from the Pollution control boards.

- There is no systematic monitoring of the implementation of the MSW and other allied rules as no organisation with clear accountabilities and responsibilities has been assigned. The result is that breaches are handled by exception following public hue and cry.²⁹

It indeed is clear, that we do not have a proactive and integrated approach to waste management. Therefore, any plan to resolve this must provide a 'best practices' based approach, with a solid planning and organisation with involvement of all key stake holders in an accountable and responsible manner.

BLUE PRINT FOR SOLID WASTE MANAGEMENT:

Choosing the right Technology:As a first step, the right technologies suitable for Indian conditions must be identified and documented with implementation guidelines for cities with different population demographics. This implies looking at the entire life cycle of waste management from the manufacture/procurement and consumption to the by-products at the end of the life cycle and focusing on at source reduction of waste -applying more contemporary technology and processes to increase the recyclable components of potential waste and establishing collection and segregation processes (such as different materials – glass, aluminium, steel,plastics etc.). The MoEF can take up the onus of developing a think tank institution that develops the technology and process aspects in a comprehensive manner. We can learn from practices followed by advanced countries and example from Japan shows the usage of techniques like- 'Recycle' 'Reuse', 'Material recycling', 'Thermal recycling (Recover heat from materials which can't be used otherwise by incineration)' and as a last measure 'Proper Disposal' of materials which cannot be used in any manner at all.

Assign accountability to Polluters: We need to define polluters more specifically within the legislation therefore not giving polluter a chance to shift the onus elsewhere owing to the

²⁹Comptroller and Auditor General, *Performance Audit Report on Management of Waste in India(Report PA14 of 2008)*, New Delhi, September 2008

loophole in the definition part. Furthermore, need to categorize the wastes that they generate so that accountabilities and responsibilities for segregation, and where needed for disposal including charging of fees/penalties, are properly assigned. This will cover not only large producers such as factories, hotels and other service organisations, but also the domestic household consumer.

- The “Responsibilities” definition is replaced with “Responsibilities of End User” and “Responsibilities of Producers/Manufacturers/Service Providers”,(service providers like hospitals, public agencies, corporate offices etc.) extending the the concept of Extended Producers responsibility in the PWM 2011 rules to all waste producers in an appropriate and unambiguous manner. Will include compulsory segregation of waste at source by type of waste that can be reprocessed for disposal.
- Define and assign responsibilities to “accredited contractors” so that indiscriminating dumping of waste by contractors can be controlled

Going Green as an imperative: A new act for Green Technology adoption for manufacturing and packaging should be piloted by MoEF, so that the quantum of disposed waste is reduced. Models seen elsewhere as in Taiwan can be considered.

Planning, Management and Organisation: This is the most neglected aspect of waste management. The current focus on waste disposal needs to progress to a hierarchical model of integration of different stakeholders into one composite matrix organisation with clear accountabilities, responsibilities and handover points. This may involve restructuring roles between the MoEF, Central Pollution Control Board, Urban development departments within state governments, State pollution control boards, Civic corporations, NGO’s, citizen groups and potential public private partnerships and also the “think tank” proposed above. The focus of this structure would be

- Life cycle of waste management
- Capacity Planning of waste management facilities in line with growth demographics
 - o Skills and resources needed
 - o Facilities like landfills, processing units etc.
- Coordinated management, project management approach, documentation and re-use of best practices
- Nodal resources for Compliance and Monitoring

- Accountabilities of waste producers and civic corporations on the other, supported by data collection.
- Compliance monitoring so that the enumerated processes are followed with the right diligence.
- Specific inclusion of targets, time lines and schedules need to be considered in the new processes that are agreed.
- Coverage to include
 - o the urban poor (low income residential and slum areas) and
 - o new/evolving (and sometimes unplanned) building settlements that escape the tax net.
- Ensure that all plans and projects have requisite statutory approvals for examples,land fills specifications by pollution control board.
- Performance monitoring
- Engage and involve the informal sector of rag pickers and “kabadi’s” along with NGO’s and other citizens groups.
- Ensure that budgets for waste management are appropriately provided for.

Providing for appropriate budgets for waste management in central and state budgets so that the integrated structure proposed above can work effectively.

The benefits of such changes are given in one of the research studies which highlights that in 2011 India could have derived the following benefits from scientific MSWM :

- 6.7 million TPY of recyclable material which could have been used as secondary raw materials in manufacturing industries, due to the absence of source separation;
- 9.6 million tons of compost which could have been used as a fertilizer supplement, due to the absence of source separation and enough composting facilities; and
- 58 million barrels of oil energy equivalent in residues of composting operations that could have been used to generate electricity and displace fossil fuels in RDF co-combustion plants or WTE power plants; due to the absence of WTE facilities, and proper policies and pollution control regulations for co-combustion of MSW in solid fuel industries.³⁰

³⁰RanjithKharvelAnnepu, *Sustainable Solid Waste Management in India*, Appendix 15,Waste-to-Energy Research and Technology Council (WTER),2012, Columbia University, p166.

LAST WORD:

MSWM is an area that is very vast in scope, which in India has focused primarily on waste disposal activities alone, that too is not enforced seriously and efficiently keeping the long term drastic impact on the environment. The existing laws need to be strengthened to focus on protecting people and the environment through an approach that reduces waste at source and ensures recovery and reuse as far as possible, while reducing the harmful effects of the same. They need to clearly define all types of wastes and their handling and introduce the “polluter pays principle” imposing deterrent penalties on polluters. The governance model needs to be completely revamped so that there is end to end responsibility of a requisite central agency within the MoEF that oversees and coordinates with clearly mandated state and local bodies for a best practices based implementation of the laws. A technology and process support central institution needs to be setup that can assimilate and propagate best practices and contemporary technology from other advanced countries localised for Indian conditions.

Bibliography

LEGISLATIONS/LAWS:

- The Environment Protection Act, 1986, Ministry of Environment and Forests, Government of India
- Notification, New Delhi, 2000, Ministry of Environment and Forests, Solid Waste Rules
- Plastic Waste Management Rules, Notification, New Delhi, 2011, Ministry of Environment and Forests,
- Plastic Manufacture Sale & Usage Rules, Notification, New Delhi, 1999 (amended 2003), Ministry of Environment and Forests
- Water (Prevention and Control of Pollution) Act, 1974, Government of India
- Water (Prevention and Control of Pollution) Cess Rules, 1978, Government of India,
- Non bio-degradable garbage (Control) Act, Simla, 1995, Himachal Pradesh Government
- Non bio-degradable garbage (Control) Act, Chandigarh, 1997, Haryana Government
- Prevention of Food Adulteration Rules, New Delhi, 1955, Government of India,

UN DOCUMENTS/ REPORTS/ GENERAL COMMENTS:

- Division of Technology, Industry and Economics. *State of Waste Management in South East Asia, Types of Wastes - Sources and Composition*, United Nations Environment Programme,

ARTICLES:

- RanjithKharvelAnnepu, *Sustainable Solid Waste Management in India*. Waste-to-Energy Research and Technology Council (WTERT),2012, Columbia University
- Dr.PawanSikka,*Plastic Waste Management in India*, Department of Science and Technology, New Delhi
- Comptroller and Auditor General, *Performance Audit Report on Management of Waste in India(Report PA14 of 2008)*, New Delhi, September 2008
- Dr, Manju Raina, *3R's for a Green Economy*, Ministry of Environment and Forests, New Delhi, October, 2010.
- Dr Vivek Agrawal, *Sustainable Waste Management; Case Study of Nagpur India*, August 28,2005

- Da Zhu and others, *Improving Municipal Solid Waste Management in India, A Source Book for Policy Makers and Practitioners*, The World Bank, Washington DC, 2008
- DarshiniMahadevia,BelaPharate,Amit Mistry, *New Practices of Waste Management – Case Mumbai, School of Planning*, CEPT University, KasturbhaiLalbhai Campus, Ahmedabad, December 2005.
- Dr Daisy Das and Dr RatulMahanta, *Municipal Solid Waste Management Study, Gauhati City*,Deptt of Economics, Gauhati University, Assam, Deptt of Economics, North Eastern Hill University, Nov 2011
- *Guidance Note: Municipal Solid Waste Management on a Regional Basis*. Ministry of Urban Development, Government of India.
- Project Notes, *Innovative Approaches to Solid Waste Management in India, Indo-US Financial Institutions Reform and Expansion Project (FIRE D)*,Chetan Vaidya, Private Sector Participation in Solid Waste Collection and Transportation, Note 15, Feb 1999
- Dr AB Harapanahalli, *Plastic Waste Management*,MoeF,New Delhi.

Websites for additional reference:

- www.indiaenvironmentportal.org.in
- www.praja.in
- www.urbanindia.nic.in
- www.niua.org