

**Report of the Committee
to
Evolve Road Map on
Management of Wastes in India**

**Ministry of Environment and Forests
New Delhi**

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FOREWARD

Rapid economic growth is leading to urbanization and industrialization generating waste which is adversely effecting the environment. To address the problem of waste management in the country the Ministry of Environment and forests, Government of India constituted a committee under my chairmanship to evolve a road map for the management of waste in India and to suggest a policy and strategy for achieving the same. The scope of the committee was to examine the existing administrative and regulatory mechanism in Wastge management. **The committee comprised of members drawn from the Central Pollution Control Board, Ministry of Urban Development, Ministry of Health and Family Welfare, Comptroller and Auditor General of India, Centre for Environment Education, Toxic Link, and National Metallurgical Laboratory.** The Committee appointed two Working Groups, which interacted with various stakeholders to evolve a consensus on the strategy for waste management. The Committee discussed and finalized the report of the Working Groups and has made number of recommendations.

Management of waste in an environmentally sustainable manner is a challenging task. It involves reusing and recycling of all types of waste ranging from domestic waste to industrial waste. Technologies have to be developed for tackling Waste Management and promoting its reuse, recycling and waste to energy operation. It is vital to involve all stakeholders in Management of Waste. These include local governmental organizations, private entrepreneurs, non-governmental organizations and civil society.

3.2 PLASTIC WASTE MANAGEMENT:

3.2.1 Present Scenario:

Plastics waste has attracted widespread attention in India, particularly due to the indiscriminate littering on open land, drains, rivers, coasts, landfill-sites etc. The plastic consumption in India, as per estimate in 2008 by CPCB was 8 MT/annum, out of which about 5.7 MT of plastics are converted into waste annually i.e. 15,722 tons of plastic waste is generated per day. Therefore the per capita generation of plastic waste has been estimated as 5.7 Kg/annum. The figures available on plastic waste are estimated on the assumption that 70% of the total plastic consumed is transformed into waste. It has been reported that 60% of total plastic waste generated is recycled and 40% is littered and remains uncollected. Therefore, approximately, 6289 tons per day (TPD) i.e. 40% of plastics are neither collected, nor recycled and find their way into drains, open lands, rivers, railway tracks and coasts. These in turn, choke drains or get dredged in the soil, making the land infertile. The littered wastes are mixed with other wastes, especially with municipal wastes thereby making it difficult for segregation.

The plastics waste constitutes two major categories of plastics:

- (i) Thermoplastics which are recyclable and
- (ii) Thermosets which are not easily recyclable

Thermoplastics, which include Polyethylene Terephthalate (PET), Low Density Poly Ethylene (LDPE), Poly Vinyl Chloride (PVC), High Density Poly Ethylene (HDPE), Polypropylene (PP), Polystyrene (PS) etc, constitute 80% of the total plastics. Thermoset plastics comprise alkyl, epoxy, ester, melamine formaldehyde, phenol formaldehyde, silicone, urea formaldehyde, polyurethane, etc. which constitute the rest 20% of the total plastics waste generated in India. Thermoplastics are recyclable plastics. Commonly littered plastic wastes include mainly the polythene carry bags, plastic wrappings, thermocol packing, plastic plates, cups, spoons etc. as recyclable plastics and *gutkha* pouches, multilayer

packaging, laminated packing etc. as non-recyclable plastic waste. . In terms of types of plastics, almost 90% of the plastic types are recyclable and only 10% of the various types of waste are non-recyclable. Thus, recycling of plastics reduces the requirement of most of the plastic. However, unsafe recycling causes health hazards as well as hazards in the environment while leading to production of products unfit for human and animal use.

3.2.2 Existing Regulatory System:

India notified the Recycled Plastics Manufacture and Usage Rules, 1999 (as amended in 2003) prohibiting the use of recycled plastic bags for storing, carrying, dispensing or packaging foodstuff. These rules also provide that minimum thickness of bags should be 20 microns and the size should not be less than 8" x 12".

The prescribed authorities for use, collection, segregation, transportation and disposal under these Rules are District Collectors (DC) and Deputy Commissioners (DyC) for plastic carry bags and the State Pollution Control Boards and Pollution Control Committees for manufacturing and recycling of plastic waste.

If minimum thickness of plastic bags is increased to 40 microns as has been done in many states, the inflow of plastic bags into the solid waste stream would be substantially reduced and the provisions effectively enforced by the State Governments/SPCBs, as it is assumed that rag pickers would be keen to segregate them for recycling purposes. However, Thin plastic bags have little value and their segregation is difficult. Besides, most PCBs and PCCs do not have the required devices to measure such minute thicknesses either onsite or in their laboratories thereby making it impossible for them to implement these standards.

Therefore, various States have notified more stringent standards and requirement for greater thicknesses of plastic carry bags than as notified in the PWM Rules. For e.g. Goa has notified 40 microns, Himachal Pradesh 70 microns, Maharashtra 50 microns, Meghalaya 40 micron, Punjab 30 micron, Chandigarh 30 micron, West Bengal 40 micron, and Kerala 30 micron as the minimum thickness of plastic carry bags required in their states.

3.2.3 International mechanism of plastic waste management:

The per capita consumption of plastics, in developed countries, is far more than in India. The technologies adopted in the developed countries for plastic waste management can be classified into four categories depending upon the importance given to PWM. These are:

- **Environment Specific technologies which include** eco-labeling, monitoring of emissions, green technologies such as fuel from waste etc.,
- **Technology Specific technologies which include** techno-economic feasibility; sustainability and innovation which are the key criteria in adopting a given technology.
- **Safety Specific technologies include** safety related issues such as hazards, risks, degradation and impact on environment.
- **Value addition Specific technologies include** improvement and quality performance from the products derived from plastic waste.

Internationally, the plastic wastes are processed in an environmentally sound manner with the following usages:

- Fuel from the plastic waste
- Plastic waste for construction of roads
- Value added products with improved performance from plastic waste

3.2.4 Issues of concern: The broad issues of concern for plastic waste management include plastic waste becoming a nuisance for all. The management of rising quantum of waste, lack of responsible stakeholders for plastic waste management, the challenge of biodegradable plastics and the existing practices of plastic recycling are all issues of great concern. It is very disturbing to note that plastic recycling in India is carried out in small, unauthorized units reprocessing thousands of tons of thermoplastics in a completely unregulated manner leading to the manufacture of highly contaminated and hazardous plastic products. Products like children's tiffin boxes, water bottles, toys, buckets and many others which contain high doses of toxic hydrocarbons like unpolymerised, free monomers, contaminants like pesticides, POPs, heavy metals such as lead, mercury, chromium, cadmium through mixing of domestic and commercial/industrial plastic waste and products derived from heating and processing plastics at inappropriate temperatures. Contaminants get into plastics also through addition of poor quality dyes and plasticizers during reprocessing of post consumer plastics under very poor conditions. Most of these substances, which are carcinogenic and toxic, cause immense damage to human health and the environment. Therefore, sustainable and safe options for plastic waste management need to be addressed urgently.

At present there is no focus on assigning responsibility and accountability at the implementation levels. Agencies are working in isolation and in an arbitrary and haphazard manner, which is evident from the fact that each state has adopted different mechanisms for dealing with the plastic waste management issue. A coordinated approach is required, assigning clear-cut responsibility and accountability to deal with the regulation. Proactive approaches are required to draw active cooperation and support from the public. There is a need for voluntary involvement of individuals, group housing societies and Panchayats for achieving concerted action.

3.2.5 Recommendations:

16. Inventory of plastic waste viz. waste generated, processed, recycled and disposed off in the country, including the details of manufacturers, processors, recyclers etc. with type and quantities of plastics being processed must be recorded; State-wise and city-wise data on plastic waste should be inventorised; This inventory would serve as the decision-support system for formulating further policies and management rules.
17. Technical manuals for each type of plastics and end use applications for the benefit of all stakeholders should be prepared. Rules for manufacture, use, reuse and recycling of plastics and monitoring mechanisms for the regulatory and implementing agencies is to be facilitated; Understanding the safety issues involved in Plastics Waste Management (PWM) is to be promoted.
18. The responsibility of Manufacturers & Processors may include the following:
 - Paying for both recyclable & non-recyclable plastics and their ultimate waste management options
 - Setting up of safe and sustainable common plastic waste management units by plastics processors/re-processors in community areas or in designated common facility locations.
 - Providing incentives for adopting non-burn and novel technologies for non-recyclables
 - Providing incentive schemes for processors & recyclers adopting environmentally sound technologies.
 - Undertaking mandatory responsibility of producers for R&D activities on plastic waste mitigation.
 - Undertaking R&D for developing truly safe and biodegradable polymers like food grade linings in cardboard cartons etc. made from tapioca starch or other such food based starch so that along with biodegradability, the polymer technology will also evolve into a complete safe packaging option for the consumers.

18. The responsibility of NGOs, Social groups and Government institutions to include the following:

- Initiation of awareness campaign amongst consumers against littering, dangers of wrong use of plastics and against burning etc.
- Creating awareness for proper plastic waste segregation & collection.

19. The responsibility of the recyclers to include the following:

- Recycling plastic waste into safe value-added products using environmentally sound techniques and adhering to food and health safety standards in an honest, self-regulatory manner.
- Creating occupationally safe employment opportunities in recycling sector by providing safe and conducive environment for workers

20. The responsibility of the concerned authorities to include the following:

- Capacity building for segregation of plastic waste at collection sites and safe handling by rag pickers.
- Channelizing the waste collection through waste collectors associations who practice safe and environmentally sound options.
- Specific responsibilities to be assigned to Panchayats, Blocks, District collectors, Municipalities for proper waste management.
- Demonstration units to be set up based on the technologies of converting plastic waste into value added products such as hand woven mats, bags, making of craft items like baskets from metalised plastics, engineered fuel, for bitumen in roads, reconversion to monomers etc. to be supported both on technical and financial fronts.
- Policies that prevent illegal practices of the trade to be enforced and decision to be driven by scientific facts.

- Converting non-biodegradable plastics into degradable may create more problems than solutions. Therefore, viable & practical practices be adopted than mere rhetoric.
 - Focus to be placed on R&D on non-recyclable plastics and their disposal, value addition by innovative ways of plastic waste utilization like reusing metalised plastics for crafts and manufacture of structural items like roofing & building material.
 - Coordinated approach for plastic waste management by manufacturers, consumers, collectors, re-cyclers as well as civic authorities.
 - Need to maintain separate waste bins designated for non-biodegradable & biodegradable plastic waste both at residential and community level. Assuring and Ensuring involvement of the informal sector in segregated collection, sorting, storage, resale and safe reprocessing.
- 21.** Educational modules to be prepared for the use of general public for awareness about the advantages and disadvantages of plastic. This would generate public support in overall system of plastic waste management at source.
- 22.** Reference materials to be prepared for various plastics for use of policy makers and regulators to ensure the implementation of plastic waste management practices. Creation of a network of R&D institutions for science-based approach for plastic waste management.
- 23.** A comprehensive document to be prepared on various technologies being adopted world over for plastic waste management. This would serve as the reference for decision-making on adoption of technologies for plastic waste management.

- 24.** Necessary infrastructure to be created for plastic waste management in various towns. Encouragement of involvement of various stakeholders especially the informal sector through self-help group formations and provision of required space and sorting facilities within the cities and towns and capability building to be initiated. Amendment to the existing plastic rules would be made by including penalty provision, definition of polluters, encouragement for waste reduction and waste recycling.
- 25.** The plastic waste rules to clearly specify actions to be taken by the DCs/DMs for enforcement of the rules relating to use, collection, segregation, transportation and disposal of plastics.
- 26.** While making structural material from post-consumer mixed plastics is one of the best ways to manage them, Indian Standards need to be established for structurals made from post-consumer plastics. For instance, PVC woven sacs, HDPE and other mixed plastics are used for making plastic strapping material often used in airports for strapping baggage. Low quality recycled strapping gives off hydrogen chloride and other hazardous emissions every time the strap is heated for strapping a bag after the screening. This is not only an occupational hazard for those at the baggage screening machines but contributes to the 'sick building' problems at airports and other locations using such material.
- 27.** Indian standards to be established for structures like water tanks, seats, benches, pre-fabricated walls and roofing from post-consumer plastics. While PE, PP, PS and others can easily be made into structures, isolating toxics and passive emissions from them needs to be integrated into the standards through adoption of sandwich techniques. Adoption of simple safety standards and monitoring techniques can ensure that a large portion of mixed post-consumer plastics can be used in making structurals, which are ideal for putting up shelters in normal and disaster situations.

3.3 Packaging Waste Management:

3.3.1 Present Scenario:

Packaging, as a strategic business tool, is the key for enhancing product characteristics and safety of the product. During last decade, packaging industry has grown exponentially. While quality improvement and better technology adoption are visible, one can also see a lot of packaging waste lying all around. Packaging waste, its collection and disposal have become an environmental challenge. Packaging waste comprise a wide range of materials that are derived from multiple items used as packaging material. Selection of appropriate waste characterization and processing technologies can tell us about the composition of waste and the action necessary to address the issues. Presently, the packaging material waste is being managed along with municipal solid waste.

Packaging and especially food packaging has considerable impact on health and environment. Styrofoam or Polystyrene (PS), Polyvinyl chloride (PVC), Polypropylene (PP), Polyethylene Teraphthalate (PET) and several others are reported to be unsafe as food and beverage packaging since polystyrene breaks down to styrene at low temperatures and often PVC has unpolymerised residual vinyl monomers in them, both of which are highly carcinogenic. All chlorinated plastics emit dioxins and furans and others benzene and ethylene oxide when incinerated besides emitting monomers like styrene, hydrogen chloride, vinyl monomers & phthalates. PET and other plastics like HDPE, LDPE and Polycarbonate having Bisphenol A leach into food and beverages even at room temperatures especially when aerated and other drinks are stored in them. Thermosets like Melamine are also known to give off acids and hydrocarbons into foods. Pigments (such as red, pink, black etc) in such packaging materials containing hexavalent Chromium, Mercury, Cadmium and Lead are carcinogenic and could harm the endocrine and neurological systems. If recycled plastics(thermoplastics) are used even in small quantities in the manufacture of food and beverages packaging, they cause major harm to human health as the

contaminated recycle can leach toxic hydrocarbons such as pesticides, fertilizers, lube oils, paints and heavy metals into the edible contents packed in them. Similarly when PVC is used for blood bags or for making dialysis units, they are known to cause toxicity in patients due to leaching of phthalates, which are plasticizers, into the blood. Similarly Poly Ethylene Glucose Saline sets are known to leach out unpolymerised hydrocarbons which could be detrimental to patients, causing allergies and lengthening their stay in hospitals.

The thermoplastics like HDPE, LDPE, PVC, PP, PS, PET or any of the thermosets are not bio-degradable. These are, sometimes, starch-filled to give the impression that they are degradable but they end up being more harmful for the environment than the non-biodegradable polymers. Plastics like Polylactic Acid (PLA) and other biopolymers made from natural starches like potato starch, oils like corn oil or palm oil are known to be completely biodegradable. PLA requires higher temperatures and specific moisture content to biodegrade. These biopolymers are expensive and are as yet not used in India on a commercial basis except in manufacture of drugs and absorbable sutures.

Fused Aluminum and plastic are used for packaging food materials. PolyAl is completely non-degradable and emits toxic fumes on burning. It could cause infertility of soil, if it gets imbedded in it, reducing permeability, porosity and fertility of the soil.

Food and Beverages packaging are high volume but may have low weights, making up only 15-20% of all packaging. They are flimsy and disposable and highly visible since they are directly disposed in the environment and are found scattered everywhere. Packaging material can be broadly classified as food and non-food packaging materials:

- (1) Food packaging material comprise of:
 - (a) Glass, ceramic and earthenware

- (b) Metals like some alloys, stainless steel and aluminum cans, foils
 - (c) Plastics
 - (d) Metalised plastics
 - (e) Laminated Paper
 - (f) Multilayer packaging
- (ii) Non-food packaging material is mostly:
- (a) Card board
 - (b) Blister plastics
 - (c) Thermocol
 - (d) Cellophane and other clear transparent and opaque plastics
 - (e) Paper
 - (f) Wood
 - (g) Multilayer Containers and strappings

The non-food packaging make up almost 80-90% of packaging by weight and its quantity is rising day by day. Despite organized collection, recycling etc., huge quantities are sent to the landfills and dumpsites which create major constraints in availability of land and other resources. They are also a major cause of pollution when burnt or incinerated.

3.3.2 Recommendations:

28. A study should be initiated for estimating the quantity and characteristics of each type of packaging material in the waste stream, major sources of its generation and existing disposal methods being practiced.
29. A policy on packaging waste management system with the participation of all stakeholders should be developed.
30. Studies on a framework for promoting clean recycling policy for packaging waste should be developed by using Life Cycle Analysis (LCA) methods.

31. Guidelines/Rules should be brought out to involve large scale retailers and user industries from pharmaceuticals, processed food industries etc. in devising strategies for managing these wastes. Bureau of Indian Standards (BIS) should be requested to frame standards for manufacture and use of packaging with the idea that their reuse and recycling should not be hazardous to human health and the environment.
32. Plastic packaging material should be characterized and their processing recommended after proper hazard assessment as also material from other Packaging materials viz., tetra pack, paper, pharma, glass and metals.
33. There is a need to prescribe standards for non-plastic packaging as well plastics.
34. Quantification and characterization of non-plastic packaging waste reaching landfill should be carried out and their recycling potential should be assessed and safe technologies for the same recommended.
35. A comprehensive legislation on packaging waste should be initiated.
36. Handling of any post-consumer waste is an issue which has a collective responsibility for producers, consumers, regulators, policy makers and enforcement agencies. Therefore, conducting mass awareness programmes for manufacturers, consumers, regulators, policy makers and citizens would have to be initiated.
37. Strategies for recovering energy by incineration of packaging waste should be discouraged and banned. Design safer packaging, sorting, separating, reuse, recycling and safe reprocessing should be encouraged and promoted.