



# Waste Management

By Utthan Samiti



*By Satendra Singh (Chairman), Utthan Samiti*



# What are Wastes?



- o Produced by the United Nations Statistics Division (U.N.S.D.):

*"Wastes are materials that are not prime products (that is products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded."*

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# Basel Convention



- o The **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal**, usually known simply as **Basel Convention**, is an international treaty that was designed to reduce the movements of hazardous waste between nations, specially to prevent transfer of hazardous waste from developed to less developed countries (LDCs). It does not, however, address the movement of radioactive waste. The convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation, and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate.
- o The Convention was opened for signature on 22<sup>nd</sup> March 1989, and entered into force on 5 May 1992.

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# Kinds of Wastes



**Solid wastes:** wastes in solid forms, domestic, commercial and industrial wastes

Examples: *plastics, Styrofoam containers, bottles, cans, papers, scrap iron, and other trash*

**Liquid Wastes:** wastes in liquid form

Examples: *domestic washings, chemicals, oils, waste water from ponds, manufacturing industries and other sources*

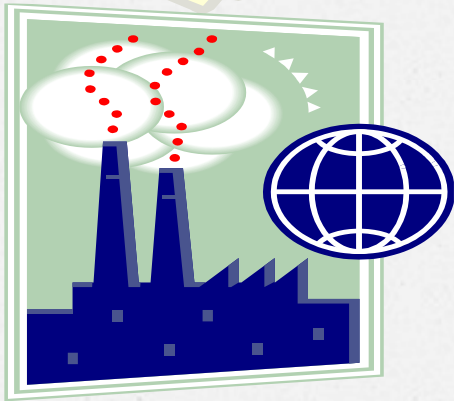
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# Sources of Wastes



**Households**



**Commerce and Industry**



By *Sumantra Singh (Chairman) Utthan Samiti*





# According to EPA regulations, **SOLID WASTE** is



- o Any garbage or refuse (Municipal Solid Waste)
- o Sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility
- o Other discarded material
- o Solid, liquid, semi-solid, or contained gaseous material from industrial, commercial, mining, and agricultural operations, and from community activities

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# Classification of Wastes according to their Properties

## Bio-degradable

can be degraded (paper, wood, fruits and others)

## Non-biodegradable

cannot be degraded (plastics, bottles, old machines, cans, Styrofoam containers and others)



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# Classification of wastes according to their origin and type



- o **Municipal Solid wastes:** Solid wastes that include household garbage, rubbish, construction & demolition debris, sanitation residues, packaging materials, trade refuges etc. are managed by any municipality.
- o **Bio-medical wastes:** Solid or liquid wastes including containers, intermediate or end products generated during diagnosis, treatment & research activities of medical sciences.
- o **Industrial wastes:** Liquid and solid wastes that are generated by manufacturing & processing units of various industries like chemical, petroleum, coal, metal gas, sanitary & paper etc.
- o **Agricultural wastes:** Wastes generated from farming activities. These substances are mostly biodegradable.

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# COLOR CODING OF BAGS FOR SEGREGATION OF BMW



COLOR	WASTE	TREATMENT
<b>Yellow</b> 	Human & Animal anatomical waste / Micro-biology waste and soiled cotton/dressings/linen/beddings etc.	Incineration / Deep burial
<b>Red</b> 	Tubings, Catheters, IV sets.	Autoclaving / Microwaving / Chemical treatment
<b>Blue / White</b> 	Waste sharps ( Needles, Syringes, Scalpels, blades etc. )	Autoclaving / Microwaving / Chemical treatment & Destruction / Shredding
<b>Black</b> 	Discarded medicines/cytotoxic drugs, Incineration ash, Chemical waste.	Disposal in secured landfill

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## COLOR CODING FOR SEGREGATION OF BMW 1998



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By Balendra Singh (Chairman) Utthan Samiti





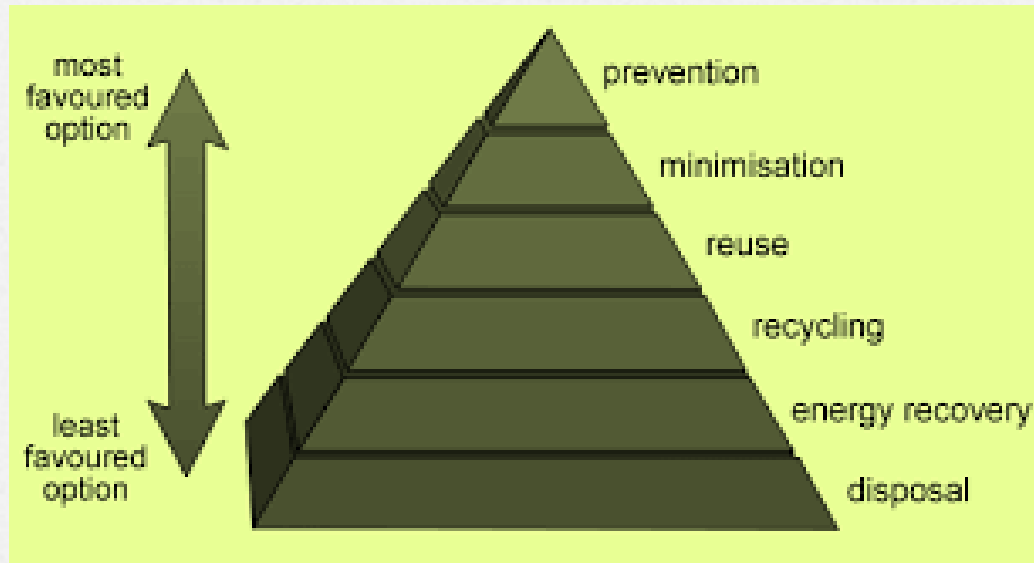
# Color coding and type of container for disposal of biomedical waste

Color coding	Type of container	Waste category	Treatment option
Yellow	Plastic bag	1, 2, 3, 6	incinerator/ deep burial
Red	Disinfected container/ plastic bags	3, 6, 7	Autoclaving,/ microwaving/ chemical
Blue/ white translucent	Plastic bags/puncture proof container	4, 7	Autoclaving,/ microwaving/ chemical treatment and destruction and shredding
Black	Plastic bags	5, 9, 10	Disposal in secured land fill.



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By *Shri Anandha Singh (Chairman) Utthan Samiti*





## Methods of Solid Waste Disposal and Management



By *Shweta Singh (Chairman) Utthan Samiti*





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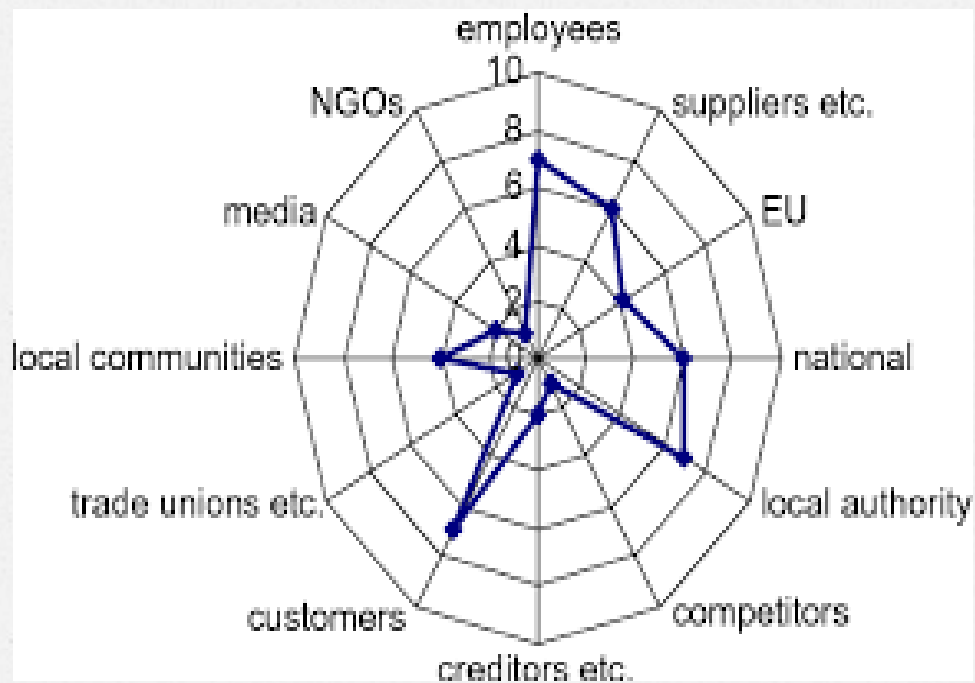


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# Solid Waste In India



- 7.2 million tonnes of hazardous waste.
- One Sq. Km. of landfill area every year.
- Rs. 1600 crore for treatment & disposal of these wastes.
- In addition to this industries discharge about 150 million tonnes of high volume low hazard waste every year, which is mostly dumped on open low lying land areas.

*Source- Ministry of Environment and Forest.*

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# Classification of wastes according to their origin and type



- **Fishery wastes:** Wastes generated due to fishery activities. These are extensively found in coastal & estuarine areas.
- **Radioactive wastes:** Waste containing radioactive materials. Usually these are byproducts of nuclear processes. Sometimes industries that are not directly involved in nuclear activities, may also produce some radioactive wastes, e.g. radio-isotopes, chemical sludge etc.
- **E-wastes:** Electronic wastes generated from any modern establishments. They may be described as discarded electrical or electronic devices. Some electronic scrap components, such as CRTs, may contain contaminants such as Pb, Cd, Be or brominated flame retardants.

# MAGNITUDE OF PROBLEM: Indian scenario



- Per capita waste generation increasing by 1.3% per annum
- With urban population increasing between 3 – 3.5% per annum
- Yearly increase in waste generation is around 5% annually
- India produces more than 42.0 million tons of municipal solid waste annually.
- Per capita generation of waste varies from 200 gm to 600 gm per capita / day. Average generation rate at 0.4 kg per capita per day in 0.1 million plus towns.

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# IMPACTS OF WASTE IF NOT MANAGED WISELY



- **Affects our health**
- **Affects our socio-economic conditions**
- **Affects our coastal and marine environment**
- **Affects our climate**
- **GHGs are accumulating in Earth's atmosphere as a result of human activities, causing global mean surface air temperature and subsurface ocean temperature to rise.**

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# IMPACTS OF WASTE IF NOT MANAGED WISELY



- Rising global temperatures are expected to raise sea levels and change precipitation and other local climate conditions.
- Changing regional climates could alter forests, crop yields, and water supplies.
- This could also affect human health, animals, and many types of ecosystems.
- Deserts might expand into existing rangelands, and features of some of our national parks might be permanently altered.

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# IMPACTS OF WASTE...



- Some countries are expected to become warmer, although sulfates might limit warming in some areas.
- Scientists are unable to determine which parts of those countries will become wetter or drier, but there is likely to be an overall trend toward increased precipitation and evaporation, more intense rainstorms, and drier soils.
- Whether rainfall increases or decreases cannot be reliably projected for specific areas.



# Impacts of waste....



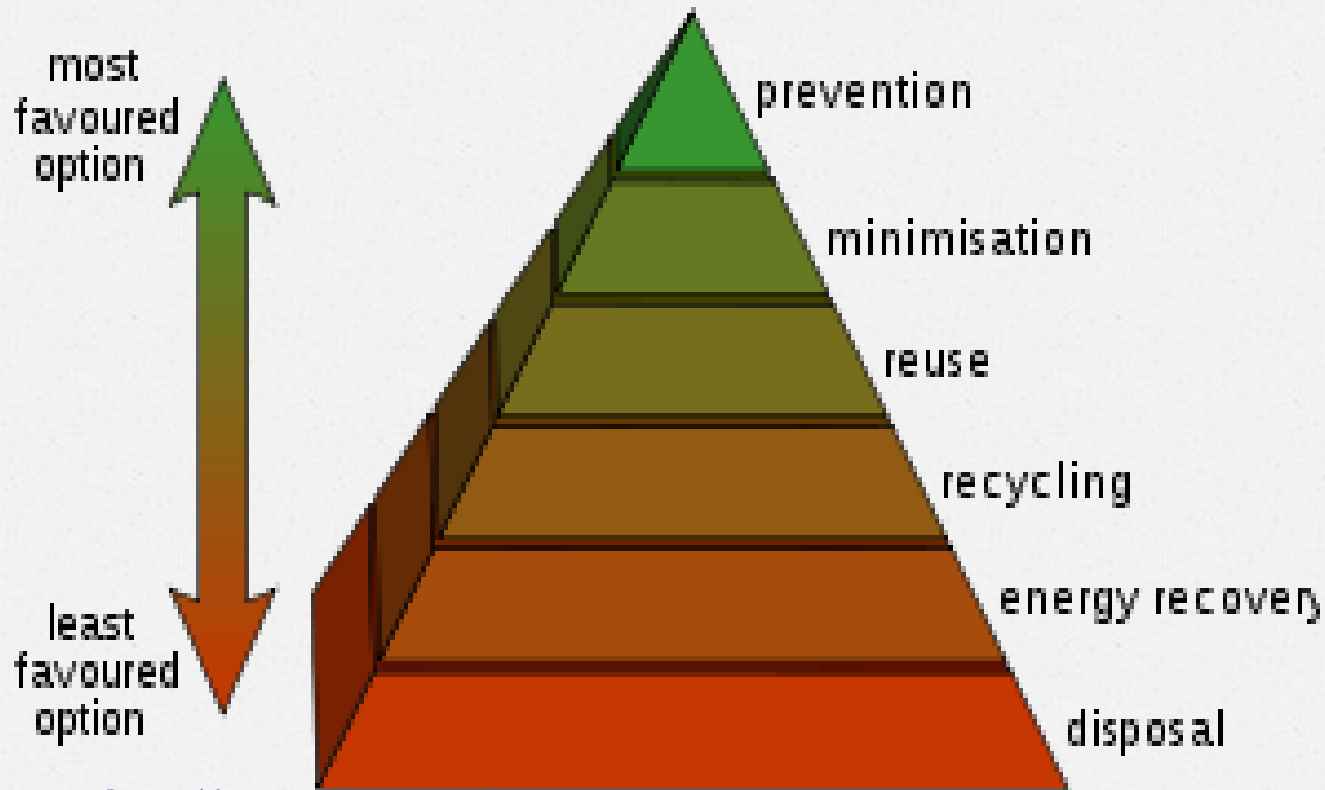
- o Activities that have altered the chemical composition of the atmosphere:
  - Buildup of GHGs primarily carbon dioxide (CO<sub>2</sub>) methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O).
  - CO<sub>2</sub> is released to the atmosphere by the burning of fossil fuels, wood and wood products, and solid waste.
  - CH<sub>4</sub> is emitted from the decomposition of organic wastes in landfills, the raising of livestock, and the production and transport of coal, natural gas, and oil.
  - NO<sub>2</sub> is emitted during agricultural and industrial activities, as well as during combustion of solid waste and fossil fuels. In 1977, the US emitted about one-fifth of total global GHGs.

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# Waste hierarchy

Waste hierarchy refers to 3 R's:-  
Reduce, Reuse, Recycle



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# Waste

## o Minimizing solid waste

- Minimizing packaging
- Recycleable  
Paper, plastics, metals,  
glass, wood
- Reusable ?  
Textiles, leather, rubber,  
metals, wood
- Compostable  
Yard trimmings, food  
scraps (vegetable)

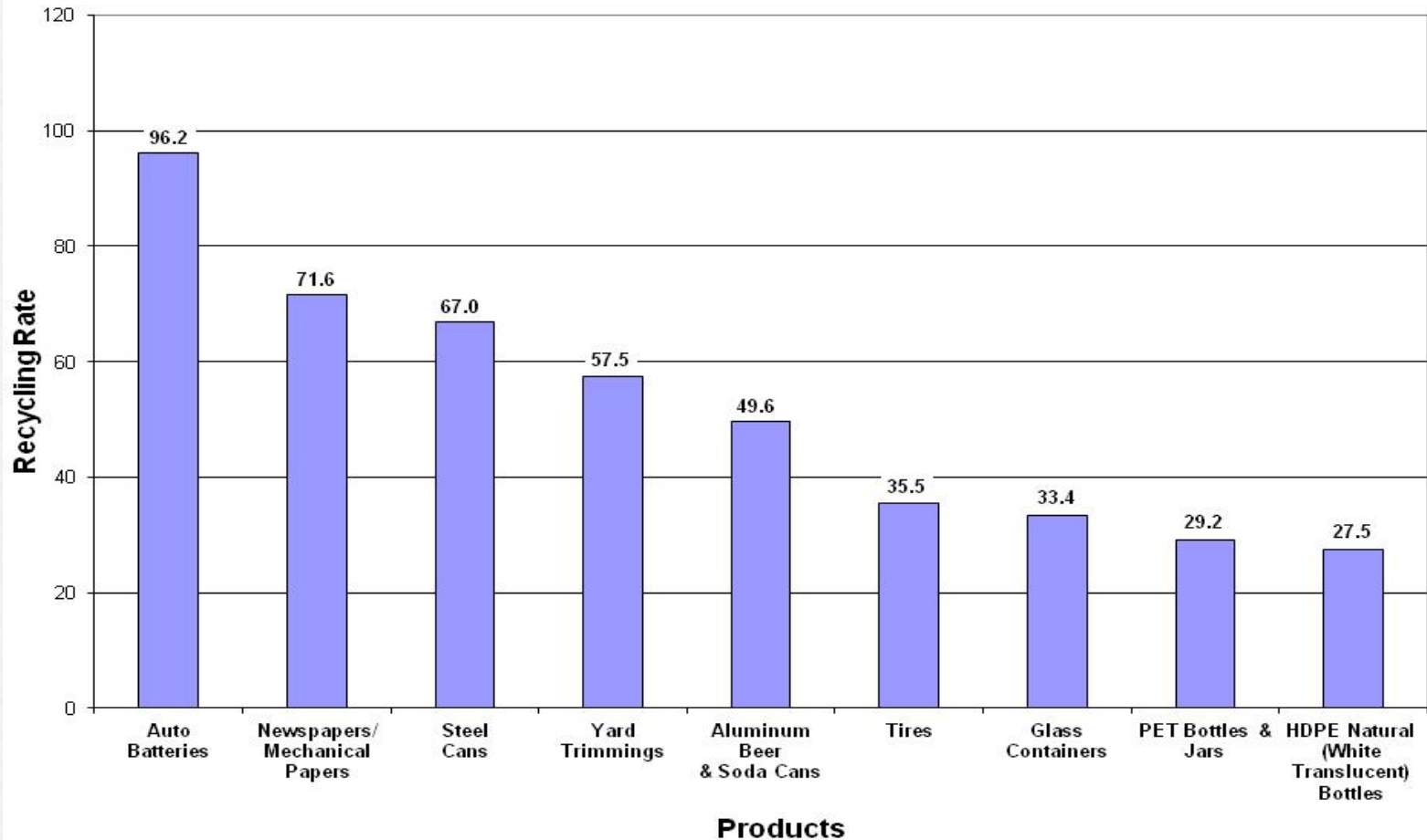


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Figure 3. Recycling Rates of Selected Products, 2010\*



“By recycling almost 8 million tons of metals (which includes aluminum, steel, and mixed metals), we eliminated greenhouse gas (GHG) emissions totaling more than 26 million metric tons of carbon dioxide equivalent (MMT $\text{CO}_2\text{E}$ ).

This is equivalent to removing more than 5 million cars from the road for one year.”

# SOURCES OF HUMAN EXPOSURES



Exposures occurs through

- o Ingestion of contaminated water or food
- o Contact with disease vectors
- o Inhalation
- o Dermal



# Points of contact



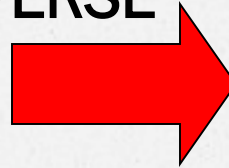
- Soil adsorption, storage and biodegrading
- Plant uptake
- Ventilation
- Runoff
- Leaching
- Insects, birds, rats, flies and animals
- Direct dumping of untreated waste in seas, rivers and lakes results in the plants and animals that feed on it

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# CATEGORIES OF WASTE DISPOSAL



## 1. DILUTE AND DISPERSE (ATTENUATION)



Throw it in the river / lake /  
sea  
Burn it

Basically this involves spreading trash thinly over a large area to minimize its impact

Works for sewage, some waste chemicals, when land-disposal is not available



## 2. CONCENTRATE AND CONTAIN (ISOLATION)



Waste dumps,  
landfills



**Historically, that's how most of the solid waste gets treated**

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# Useful options



- o Resource recovery
- o Composting
- o Vermicomposting
- o Energy recovery
- o Incineration
- o Pyrolysis
- o Gasification
  - o Bio-Methanation or anaerobic digestion

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# Impacts of waste on health



- Chemical poisoning through chemical inhalation
- Uncollected waste can obstruct the storm water runoff resulting in flood
- Low birth weight
- Cancer
- Congenital malformations
- Neurological disease

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# Effects of waste on animals and aquatics life



- Increase in mercury level in fish due to disposal of mercury in the rivers.
- Plastic found in oceans ingested by birds.
- Resulted in high algal population in rivers and sea.
- Degrades water and soil quality.



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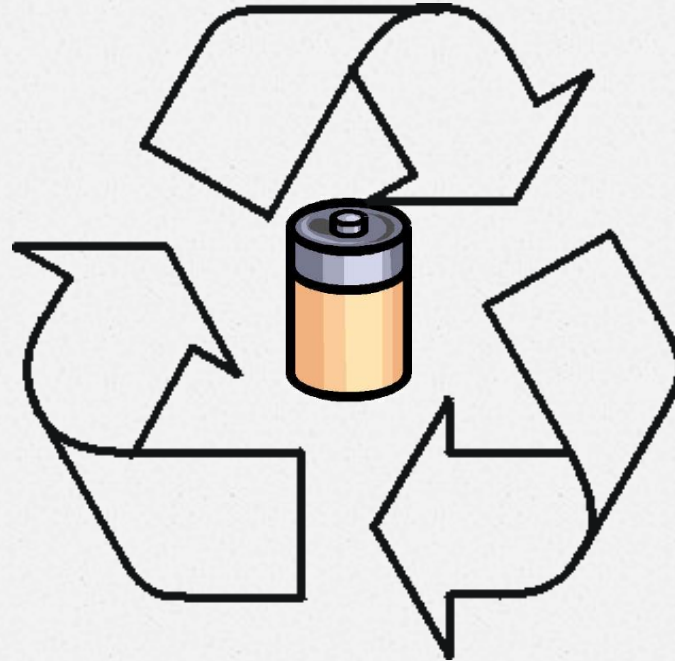
# Impacts of waste on Environment



- Waste breaks down in landfills to form methane, a potent greenhouse gas
- Change in climate and destruction of ozone layer due to waste biodegradable
- Littering, due to waste pollutions, illegal dumping, Leaching: is a process by which solid waste enter soil and ground water and contaminating them.

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# Battery Recycling



Industries Waste Management

*By Satendra Singh (Chairman) Utthan Samiti*



# Introduction

- o Why should we recycle batteries?
  - o Where solid waste goes
  - o Facts about battery consumption
- o How does industry view battery recycling?
- o How does battery recycling work?
  - o Lead Acid
- o Recycling and other options

# Why should we recycle?

o Where does waste go?

o Landfills

o Trash storage

o Some methane production

o Incinerators

o Energy

o Volume reduction

o Break down some compounds





# Why should we recycle?

- Americans purchase nearly 3 billion dry-cell batteries every year.
- 350 million are rechargeable.
- Only 3-5% of primary dry cells are recycled.
- Nearly 99 million wet-cell lead-acid car batteries are manufactured each year.
- A primary battery will only return 1/50 the energy used to make it.
- Batteries contain heavy metals such as mercury, lead, cadmium, and nickel, which can contaminate the environment when batteries are improperly disposed of.
- The oceans are starting to show elevated levels of cadmium.
- NiCd batteries account for 75% of cadmium in landfills.
- Preserve natural resources.

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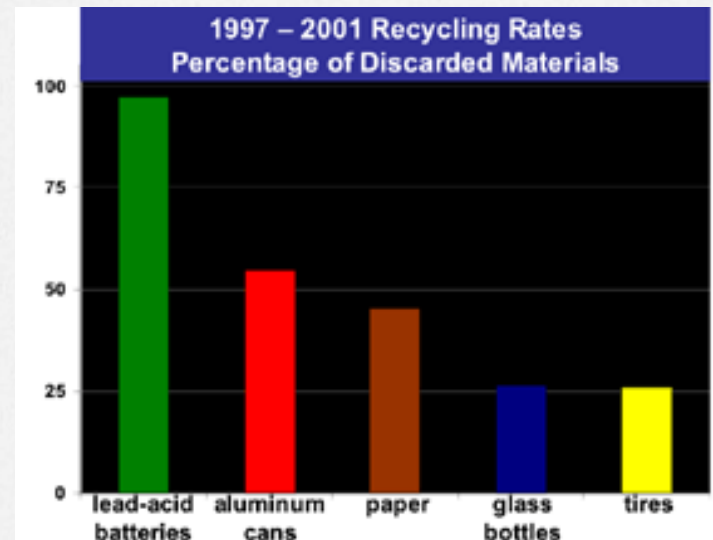


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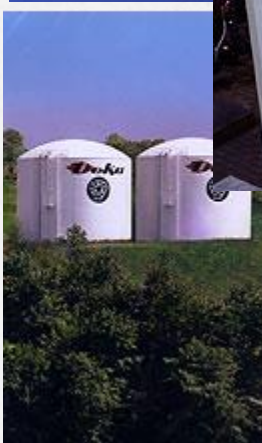
# Industry and Recycling

- Companies claim it is not economically profitable.
  - Transportation
  - Sorting
- Lead acid batteries are the most recycled product.



# How recycling works

- o Lead Acid Recycling
  - o Plastic is broken up and reused
  - o Lead and lead oxide is smelted
  - o Sulfuric acid is reclaimed





# Pyrometallurgical and Hydrometallurgical extraction

- o Allows metals to be reclaimed from oxides.
- o  $\text{PbO(s)} + \text{CO(g)} \rightarrow \text{Pb(s)} + \text{CO}_2\text{(g)}$
- o Hydrometallurgical extraction
- o  $\text{Cu}^{2+}\text{(aq)} + \text{H}_2\text{(g)} \rightarrow \text{Cu(s)} + 2\text{H}^+$



# Recycling other types of batteries

## o NiCd

- o batteries can be reprocessed through a similar thermal technique

## o NiMH

- o The output of this process is a product with high nickel content which can be used in the manufacture of stainless steel.

## o Li-Ion

- o currently reprocessed through pyrolysis (heat treatment) with the primary recovery the metal content.

## o Zinc-carbon/air and alkaline-manganese

- o can be reprocessed using a number of different methods, which include smelting and other thermal-metallurgical processes to recover the metal content (particularly zinc).

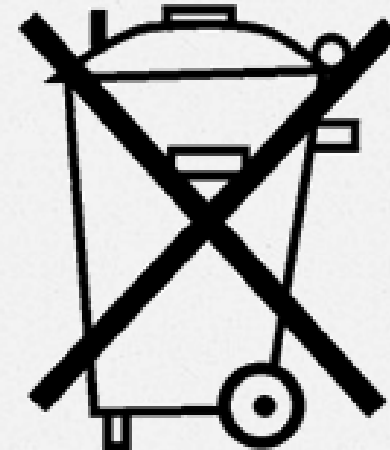
## o Batteries containing mercury

- o Most commonly processed using a vacuum-thermal treatment



# Advances

- o Mercury battery act
  - o Phase out mercury
  - o Increase Recycling
- o Rechargeable Battery Recycling Corporation
  - o Since 1994, RBRC has recycled more than 20 million pounds of rechargeable batteries.
- o Battery Counsel International



# Solutions

- o Purchase rechargeable batteries.
- o Use solar power
- o Battery Deposit
- o Make companies take back products they sell.
- o Make batteries easier to recycle.





# Resources

- o [www.epa.gov](http://www.epa.gov)
- o [www.energy.gov](http://www.energy.gov)
- o [www.wasteonline.org.uk](http://www.wasteonline.org.uk)
- o [www.bbc.co.uk](http://www.bbc.co.uk)
- o <http://www.batteryrecycling.com/index.html>
- o Inorganic Chemistry (Shriver, Atkins)
- o Recycling of Consumer Dry Cell batteries (Hurd et al.)
- o [http://www.relife.com/IDetoxamin/cadmium\\_toxicity.htm](http://www.relife.com/IDetoxamin/cadmium_toxicity.htm)
- o [www.zerowasteamerica.org](http://www.zerowasteamerica.org)

# Industrial Wastes *Challenges and Issues*

*By Satendra Singh (Chairman) Utthan Samiti*



# Industrial Wastes and Categories

- As such there is no such standard definition of industrial waste
- Industrial waste refers to the solid, liquid and gaseous emissions, residual and unwanted wastes from an industrial operation

Industrial wastes could be classified into two types.

- Hazardous industrial waste
- Non-hazardous industrial waste

# Hazardous Industrial Waste

- Hazardous wastes, which may be in solid, liquid or gaseous form, may cause danger to health or environment, either alone or when in contact with other wastes.
- Over 6.2 million tonnes annually.
- It is presumed that about 10 to 15 percent of wastes produced by industries are hazardous.
- Generation of hazardous wastes is increasing at the rate of 2 to 5 percent per year.
- 141 dumpsites identified and 88 critically polluted areas.

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# Hazardous Waste Generation: India

- Hazardous Waste Generating Industries in India - 36,165 nos.
- Hazardous Waste Generation - 62,32,507 MTA
- The category-wise classification of this quantity is
  - Land Fillable HW – 27,28,326 MTA
  - Incinerable HW - 4,15,794 MTA
  - Recyclable HW - 30,88,387 MTA

# The Indian industrial sector **solid wastes**

- o The Indian industrial sector generates an estimated **100 Million Tonnes per year of solid wastes**, with coal ash from thermal power stations accounting for more than 70 million tons/year
- o Source –
  - *National Inventory of Hazardous Wastes Generating Industries & Hazardous Waste Management in India Feb 2009*
  - [http://ebtc.eu/pdf/111031\\_SNA\\_Snapshot\\_Waste-management-in-India.pdf](http://ebtc.eu/pdf/111031_SNA_Snapshot_Waste-management-in-India.pdf)



# Some contaminants of concern:-

Hazardous waste in particular includes products that are explosive, flammable, irritant, harmful, toxic, carcinogenic, corrosive, infectious, or toxic to reproduction

- o Arsenic Mining, non anthropogenic geo-chemical formation
- o Cadmium Mining, fertilizer industry, battery waste
- o Chromium Mining areas, Tanneries
- o Lead Lead acid battery smelters : paint sludge
- o Manganese Mining areas
- o Mercury Chlor-alkali industries, healthcare institutes
- o Nickel Mining, metal refining
- o Benzene Petrochemical industries, solvents
- o Vinyl chloride Plastics
- o Pesticides Insecticides - runoffs
- o Dioxins Waste incineration, herbicides
- o PCBs Fluorescent lights, e-waste, Hydraulic fluid

# Non -hazardous Industrial Waste

- o Non-hazardous or ordinary industrial waste is generated by industrial or commercial activities, but is similar to household waste by its nature and composition
- o It is not toxic, presents no hazard and thus requires no special treatment
- o In particular, it includes ordinary waste produced by companies, shopkeepers and trades people (paper, cardboard, wood, textiles, packaging, etc.)



## Major Haz. Waste Generating States in India

Name of State	Quantity of Hazardous Waste generation (MTA)			Total
	Landfillable	Incinerable	Recyclable	
Andhra Pradesh	211442	31660	313217	556319
Chhattisgarh	5277	6897	283213	295387
Gujarat	1107128	108622	577037	1792787
Jharkhand	23135	9813	204236	237184
Maharashtra	568135	152791	847442	1568368
Punjab	13601	14831	89481	117913
Rajasthan	165107	23025	84739	272871
Tamil Nadu	157909	11145	89593	258647
West Bengal	120598	12583	26597	259777

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# Treatment Facilities

- o Common Treatment, Storage and Disposal Facilities (TSDF) for HW:  
27 different places in 14 States only
- o Gujarat (8 Nos.),
- o Maharashtra (4 Nos.),
- o Uttar Pradesh (3 Nos.),
- o Andhra Pradesh (2 Nos.),
- o Himachal Pradesh, Madhya Pradesh, Punjab, Rajasthan, Tamil Nadu, West Bengal, Karnataka, Kerala, Uttarakhand, Daman Diu Dadar & Nagar Haveli each state have 1No. And
- o Total 88 CETPs (having a total installed capacity of 560 MLD) covering more than 10000 industries are in operation across the country and 56 CETPs are planned over the next few years.



# Salient Features

Hazardous and Other Wastes (Management and Transboundary) Rules, 2016  
(India is also signatory to Basel, Stockholm and Rotterdam Conventions)

- o In the revised rules other waste has been added
- o The new Hazardous Waste Rules focus on resource recovery and disposal of hazardous waste in environmentally sound manner.
- o The occupier will follow prevention, minimization, reuse, recycling, recovery, utilization including co-processing and safe disposal of hazardous and other wastes.
- o Will provide specific information for safe storage and disposal to TSDF facility operator.
- o The occupier will provide appropriate training, equipment to the person working in and the information necessary to ensure their safety.
- o The Ministry of Environment, Forest and Climate Change or the Central Pollution Control Board may issue guidelines or standard operating procedures for environmentally sound management of hazardous and other wastes from time to time.

# Way ahead:-

- o Good inventorisation.
- o Reduce, reuse, recycle and waste minimization s key.
- o Cleaner production and identifying clean technologies for each sector
- o Cost sharing basis for treatment and disposal based on polluter pays principle and PPP.
- o Collection mechanisms especially for highly hazardous waste, with on line tracking systems.
- o Setting up waste exchange banks and information sharing centers.
- o Gaps of TSDF to be filled
- o Industry associations to play a more active role.
- o Better harmonization with Customs for illegal trade prevention.
- o Improved and stronger regulatory oversight.



# WHAT SHOULD BE DONE

## ❑ Reduce Waste

- Reduce office paper waste by implementing a formal policy to duplex all draft reports and by making training manuals and personnel information available electronically.
- Improve product design to use less materials.
- Redesign packaging to eliminate excess material while maintaining strength.
- Work with customers to design and implement a packaging return program.
- Switch to reusable transport containers.
- Purchase products in bulk.



*By Satendra Singh (Chairman) Utthan Samiti*

# WHAT SHOULD BE DONE

## □ Reuse

- Reuse corrugated moving boxes internally.
- Reuse office furniture and supplies, such as interoffice envelopes, file folders, and paper.
- Use durable towels, tablecloths, napkins, dishes, cups, and glasses.
- Use incoming packaging materials for outgoing shipments.
- Encourage employees to reuse office materials rather than purchase new ones.



By *Siddhanta Singh (Chairman) Utthan Samiti*





# WHAT SHOULD BE DONE

## Donate/Exchange

- old books
- old clothes
- old computers
- excess building materials
- old equipment to local organizations



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# WHAT SHOULD BE DONE

## Employee Education

- Develop an “office recycling procedures” packet.
- Send out recycling reminders to all employees including environmental articles.
- Train employees on recycling practices prior to implementing recycling programs.
- Conduct an ongoing training process as new technologies are introduced and new employees join the institution.



*By Dr. Madhira Singh (Chairman) Utthan Samiti*





# WHAT SHOULD BE DONE

## ❑ Employee Education

- education campaign on waste management that includes an extensive internal web site, quarterly newsletters, daily bulletins, promotional signs and helpful reference labels within the campus of an institution.



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# WHAT SHOULD BE DONE

❑ Conduct outreach program adopting an ecologically sound waste management system which includes:

- waste reduction
- segregation at source
- composting
- recycling and re-use
- more efficient collection
- more environmentally sound disposal



*By Lalendra Singh (Chairman) Utthan Samiti*





Let's Make Our India  
“Clean, Green & Healthy”

Thank You



*By Satendra Singh (Chairman) Utthan Samiti*