

# Hospital Waste Management

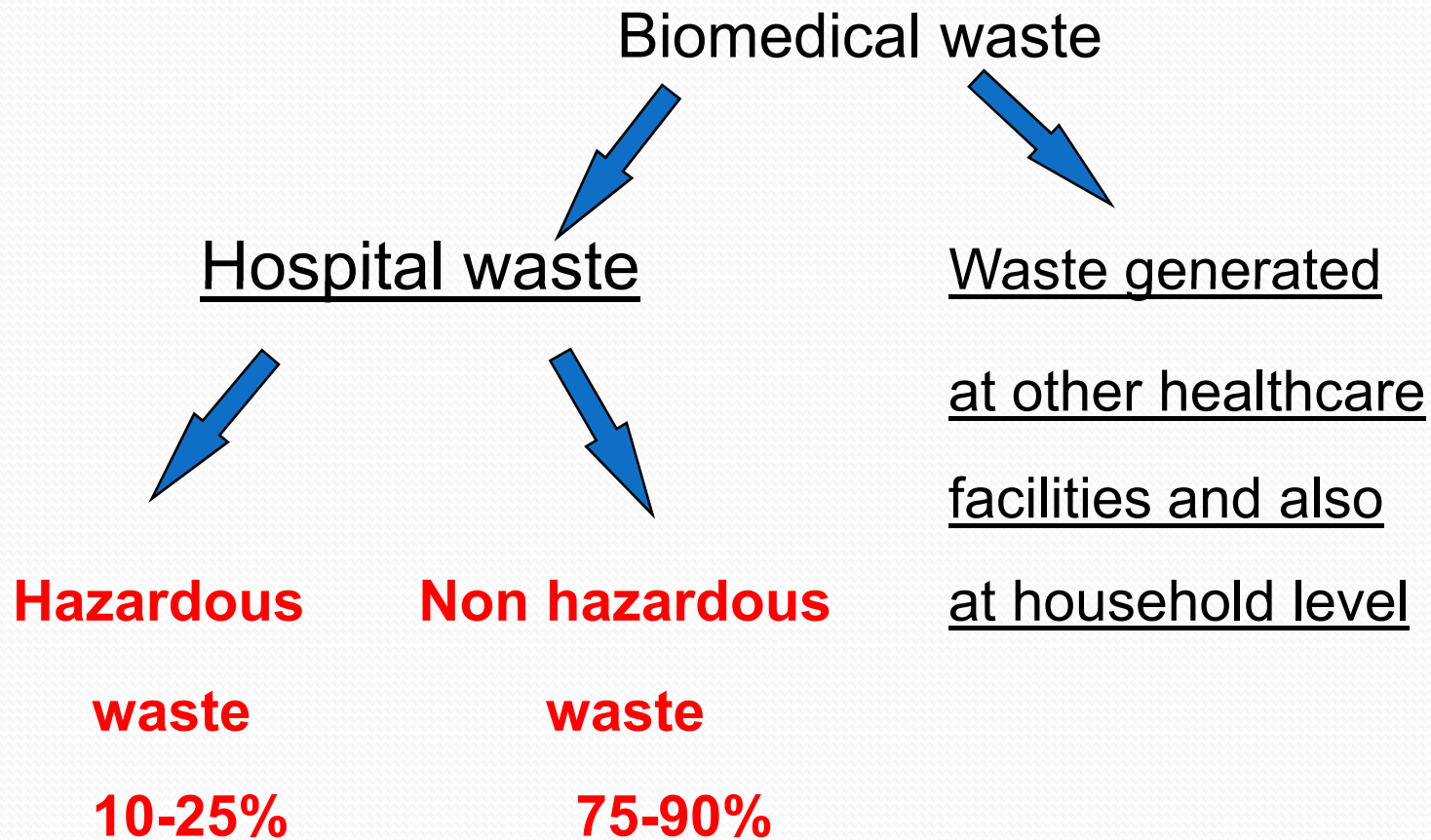
Let the wastes of  
“The Sick”  
Not contaminate the lives of  
“The Healthy”



# What is Biomedical Waste?

- Biomedical waste is defined as waste which is generated during diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biologicals.
- Not only at hospitals, but also produced at household levels.

# Types of biomedical Waste



<b>Waste Category</b>	<b>Description and example</b>
Infectious Waste	Waste suspected to contain pathogens e.g. laboratory cultures; waste from isolation wards; tissues (swabs), materials, or equipments that have been in contact with infected patients; excreta
Pathological waste	Human tissues or fluids e.g. body parts; blood and other body fluids; fetuses
Sharps waste	e.g. needles; infusion sets scalpels; knives; blades; broken glass

<b>Waste Category</b>	<b>Description and example</b>
Pharmaceutical Waste	Waste containing pharmaceuticals e.g. pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals (bottles, boxes)
Genotoxic Waste	Waste containing substances with genotoxic waste properties e.g. waste containing cytostatic drugs (often used in cancer therapy); genotoxic chemicals

<b>Waste Category</b>	<b>Description and example</b>
Chemical Waste	Waste containing chemical substances e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed; solvents
Wastes with high content of heavy metals	Batteries; broken thermometers; blood-pressure gauges; etc.

<b>Waste Category</b>	<b>Description and example</b>
Pressurized containers	Gas cylinders; gas cartridges. aerosol cans
Radioactive Waste	Waste containing radioactive substances e.g. unused liquids from radiotherapy or laboratory research; contaminated glassware, packages, or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides;



# Sources of health-care waste

- Government hospitals, Private hospitals, Nursing homes
- Physician's office/clinics
- Dentist's office/clinics
- Dispensaries
- Primary health centres
- Medical research and training establishments
- Mortuaries





# Sources of health-care waste

- Blood banks and collection centres
- Animal houses
- Slaughter houses
- Laboratories
- Research organizations
- Vaccination centres
- Bio-technology institutions/production units

# Health hazards of health-care

## waste

- (a) it contains infectious agents;
- (b) it contains toxic or hazardous chemicals or pharmaceuticals;
- (c) it contains sharps;
- (d) it is genotoxic; and
- (e) it is radio-active.



# The main groups at risk are :

- Medical doctors, nurses, health-care auxiliaries, and hospital maintenance personnel;
- Patients in health-care establishments;
- Visitors to health-care establishments;
- Workers in support service allied to health-care establishments such as laundries, waste handling and transportation; and
- Workers in waste disposal facilities such as land fills or incinerators including scavengers.



# 1. Hazards from infectious waste and sharps

- Pathogens in infectious waste may enter the human body through a puncture, abrasion or cut in the skin, through mucous membranes by Inhalation or by ingestion.
- HIV and hepatitis virus B and C, - a strong evidence of transmission via health-care waste.



## 2. Hazards from chemical and pharmaceutical waste

- Many of the chemicals and pharmaceuticals used in health-care establishments are toxic, genotoxic, corrosive, flammable, reactive, explosive or shock-sensitive.
- Although present in small quantity they may cause intoxication, either by acute or chronic exposure, and injuries, including burns.



### 3. Hazards from genotoxic waste

- Exposure may occur during handling or disposal of genotoxic waste and also during the preparation of or treatment with particular drug or chemical.
- The main pathway of exposure is inhalation of dust or aerosols, absorption through the skin, ingestion of food accidentally contaminated with cytotoxic drugs, chemicals or wastes etc.



## 4. Hazards from radioactive waste

- The type of disease caused by radioactive waste is determined by the type and extent of exposure.
- It can range from headache, dizziness and vomiting to much more serious problems.
- Because it is genotoxic, it may also affect genetic material.



## 5. Public sensitivity

- Apart from health hazards, the general public is very sensitive to visual impact of health-care waste particularly anatomical waste.



# Disposal technologies for health care waste

## 1) INCINERATION

- Principle- it is high temperature **dry oxidation process** that **reduces organic & combustible waste to inorganic & incombustible matter** & result in significant reduction in weight & volume.
- Usually apply to the waste which can not be recycle or reused or disposed in landfill site.



## **Waste suitable for incineration are :**

- (A) low heating volume
- (b) content of combustible matter above 60 per cent;
- (c) content of noncombustible solids below 5 per cent;
- (d) Content of noncombustible fines below 20 per cent;
- (e) moisture content below 30 per cent.



## **Waste types not to be incinerated are**

- (a) Pressurized gas containers;
- (b) Large amount of reactive chemical wastes;
- (c) Silver salts and photographic or radiographic wastes;
- (d) Halogenated plastics such as PVC;
- (e) Waste with high mercury or cadmium content, such as broken thermometers, used batteries, and lead-lined wooden panels; and
- (f) Sealed ampules or ampules containing heavy metals.



# Types of incinerator

- 1) ***Double chamber pyrolytic incinerator*** – specially design to burn infectious waste
- 2) ***Single chamber furnace with static grate*** – only use when the pyrolytic are not affordable
- 3) ***Rotatory kilns*** – capable of causing decomposition of genotoxic material & heat resistant materials



## 2) CHEMICAL DISINFECTION

- Chemical is added to waste to kill or inactivate the pathogen it contain.
- Most suitable for liquid waste such as blood, urine, stool & hospital sewage



### 3) WET & DRY THERMAL TREATMENT

- **WET THERMAL TREATMENT-** It is based on exposure of shredded infectious waste to high temperature, high pressure stream & similar to autoclave sterilization process.
- **SCREW FEED TECHNOLOGY** – this is on the basis of non burn, dry thermal disinfection process in which waste is shredded & heated in rotating auger. Waste is reduced by 80% and in volume by 20-35% in weight.



## 4) MICROWAVE IRRADIATION

- Micro Organism are destroyed by the action of microwave of a frequency 2450 MHz
- Infectious component are destroyed by heat conduction.
- Efficiency should be checked routinely by bacteriological & virological test.



## 5) LAND DISPOSAL

- **LAND OPEN DUMPS & SANITARY LANDFILL**

- Waste should not be deposited in or around open dumps.
- sanitary landfill are designed to have at least 4 advantage over open dump
  - (a) Geological isolation of waste from environment
  - (b) appropriate engineering preparation before site is ready to accept waste.
  - (c) staff present at operation site to control operation.
  - (d) organized deposit & daily coverage of waste





## 6) INERTIZATION

- It involve mixing waste with cement & other substance before disposal, in order to minimize the risk of toxic substance contained waste migrating into the surface water & ground water.
- A typical proportion of mixture is:
  - 65% pharmaceutical waste
  - 15% lime
  - 15% cement
  - 5% water ,
- cubes are produced on site & transported to the storage site

# Schedule I-

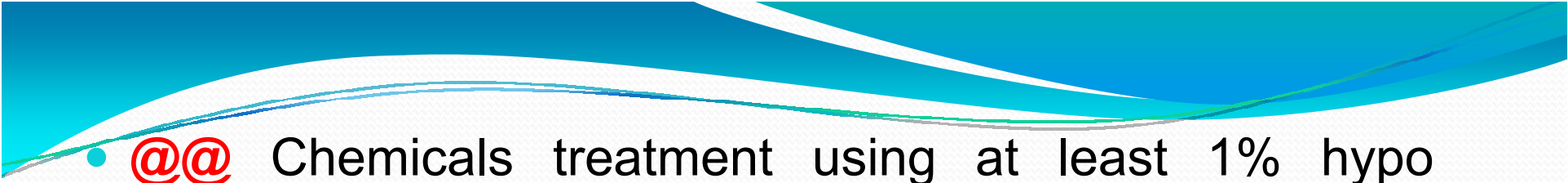
## CATEGORIES OF BIOMEDICAL WASTE

Category	Waste Category	Treatment & Disposal
1	<b><u>Human Anatomical Waste</u></b> (human tissues, organs, body parts)	Incineration@/ deep burial*
2	<b><u>Animal Waste</u></b> (animal tissues, organs, body parts, carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals, colleges, discharge from hospitals, animal houses)	Incineration@ / deep burial*

Category	Waste Category	Treatment & Disposal
3	<p><b><u>Microbiology &amp; Biotechnology Waste</u></b>  (wastes from laboratory cultures, stocks or specimens of microorganisms, live or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins, dishes and devices used for transfer of cultures.)</p>	Local autoclaving / microwaving / incineration@
4	<p><b><u>Waste sharps</u></b>  (needles, syringes, scalpels, blades, glass etc. that may cause puncture and cuts. This includes both used and unused sharps.)</p>	Disinfection (chemical treatment@@) / auto claving / microwaving and mutilation / shredding##

Category	Waste Category	Treatment & Disposal
5	<p><b><u>Discarded Medicines and Cytotoxic drugs</u></b>            (wastes comprising of outdated, contaminated and discarded medicines)</p>	Incineration@ / destruction and drugs disposal in secured landfills
6	<p><b><u>Soiled Waste</u></b>            (Items contaminated with blood and body fluids including cotton, dressings, soiled plaster casts, linens, beddings, other material contaminated with blood)</p>	Incineration@ autoclaving / Microwaving
7	<p><b><u>Solid Waste</u></b>            (wastes generated from disposable items other than the waste sharps such as tubings, catheters, intravenous sets etc.)</p>	Disinfection by chemical treatment@@ / autoclaving / microwaving and mutilation/shreddi ng##


Category	Waste Category	Treatment & Disposal
8	<p><b><u>Liquid Waste</u></b>            (Waste generated from laboratory and washing, cleaning, house keeping and disinfecting activities)</p>	<p>Disinfection by chemical treatment@@            And discharge Into Drains</p>
9	<p><b><u>Incineration Ash</u></b>            (ash from incineration of any bio-medical waste)</p>	<p>Disposal in municipal landfill</p>
10	<p><b><u>Chemical Waste</u></b>            (chemicals used in production of biological, chemicals used in disinfection, as insecticides, etc.)</p>	<p>Chemical treatment@@            And discharge Into drains for liquids and secured landfill For solids.</p>

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- @@ Chemicals treatment using at least 1% hypo chlorite solution or any other equivalent chemical reagent. It must be ensured that chemical treatment ensures disinfections.
  - ## Mutilation/shredding must be such so as to prevent unauthorized reuse.
  - @ There will be no chemical pretreatment before incineration. Chlorinated plastics shall not be incinerated.
  - \* Deep burial shall be an option available only in town, with population less than five lacs and in rural areas.

# CATEGORIES OF BMW






Categories

COLOR CODE	TYPE OF BAG/ CONTAINER	TYPE OF WASTE	TREATMENT OPTIONS
Yellow	Yellow coloured non-chlorinated plastic bags  	(a) Human Anatomical Waste	Incineration or Plasma Pyrolysis or deep burial
		(b) Animal Anatomical Waste	
		(c) Soiled Waste:	
		(d) Expired or Discarded Medicines:	Returned back to the manufacturer or supplier for incineration
	(e) Chemical Waste	Disposed of by incineration or Plasma Pyrolysis or Encapsulation	
	Separate collection system leading to effluent treatment system	(f) Chemical Liquid Waste	Chemical liquid waste shall be pre-treated before mixing with other wastewater
Non-chlorinated yellow plastic bags or suitable packing material	(g) Discarded linen, mattresses, beddings contaminated with blood or body fluid.	Non-chlorinated chemical disinfection followed by incineration or Plasma Pyrolysis or for energy recovery	
Autoclave safe plastic bags or containers	(h) Microbiology, Biotechnology and other clinical laboratory waste:	Pre-treat to sterilize with nonchlorinated chemicals on-site	

# CATEGORIES OF BMW



Categories

COLOR CODE	TYPE OF BAG/ CONTAINER	TYPE OF WASTE	TREATMENT OPTIONS
Red	Red coloured non-chlorinated plastic bags or containers 	Contaminated Waste (Recyclable)	Autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent to registered or authorized recyclers
White (Translucent)	Puncture proof, Leak proof, tamper proof containers 	Waste sharps including Metals:	Autoclaving or Dry Heat Sterilization followed by shredding
Blue	Cardboard boxes with blue colored marking 	(a) Glassware	Disinfection and then sent for recycling.
		(b) Metallic Body Implants	



## SCHEDULE II

### COLOUR CODING AND TYPE OF CONTAINER FOR DISPOSAL OF BIOMEDICAL WASTES

<b>Color Coding</b>	<b>Type of Container</b>	<b>Waste Category</b>	<b>Treatment option Schedule I</b>
<u>Yellow</u>	Plastic bag	Cat.1, Cat. 2 and Cat. 3, Cat. 6	Incineration / deep burial
<u>Red</u>	Disinfected container/ plastic bag	Cat. 3, Cat. 6, Cat. 7	Autoclaving/ Microwaving / Chemical Treatment
<u>Blue/</u> <u>White</u> Translu- cent	Plastic bag/ puncture proof container	Cat. 4, Cat. 7	Autoclaving/ Microwaving / Chemical Treatment and destruction/ shredding
<u>Black/</u> <u>Green</u>	Plastic bag	Cat. 5 and Cat. 9 and Cat. 10. (solid)	Disposal in secured landfill



**“United Nations Conference on the Environment & Development” : Recommendation:**

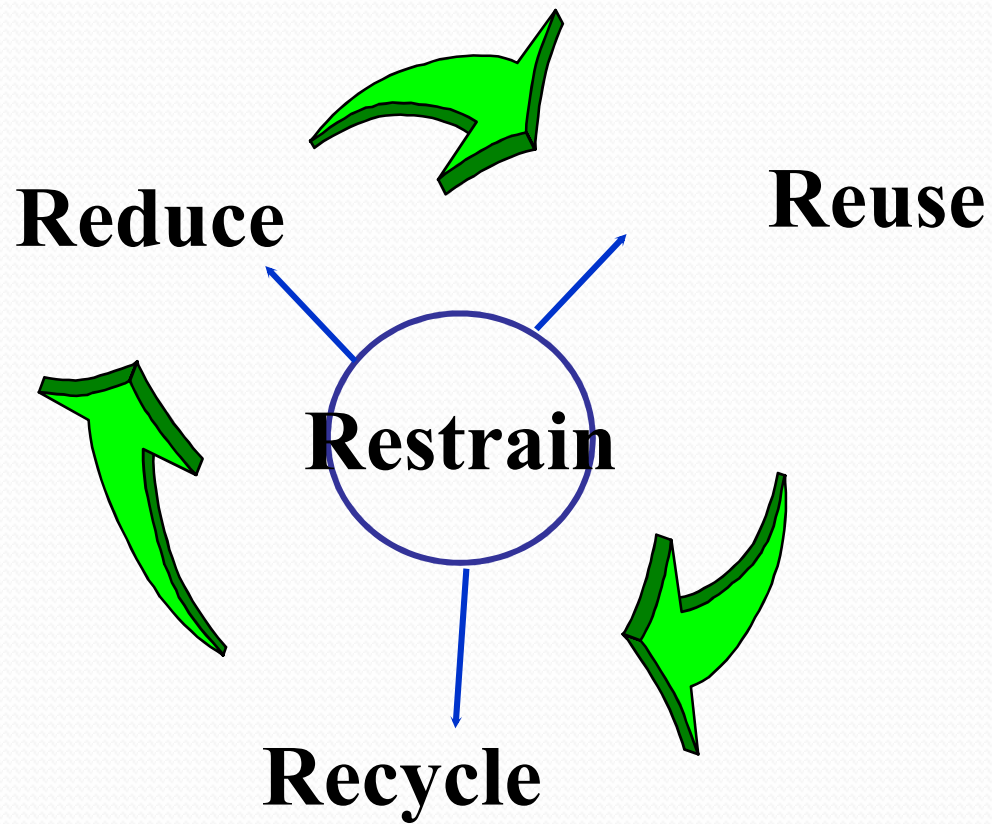
- Prevent & minimize waste production
- Reuse or recycle the waste to the extent possible
- Treat waste by safe & environmentally sound methods
- Dispose off the final residue by landfill in confined & carefully designed sites



# Law

- The Biomedical Waste ( Management and Handling ) Rules, 1998.
- These rules apply to all persons who generate, collect, receive, store, transport, treat, dispose, or handle biomedical waste in any form.

**Principles of Health Care Waste Management keep the  
waste\_under control**





# Reuse

- Use of reusable items made of glass and metal
- Selecting non PVC plastics
- Ensuring segregation of waste at source
- Establishing an effective and sound recycling policy



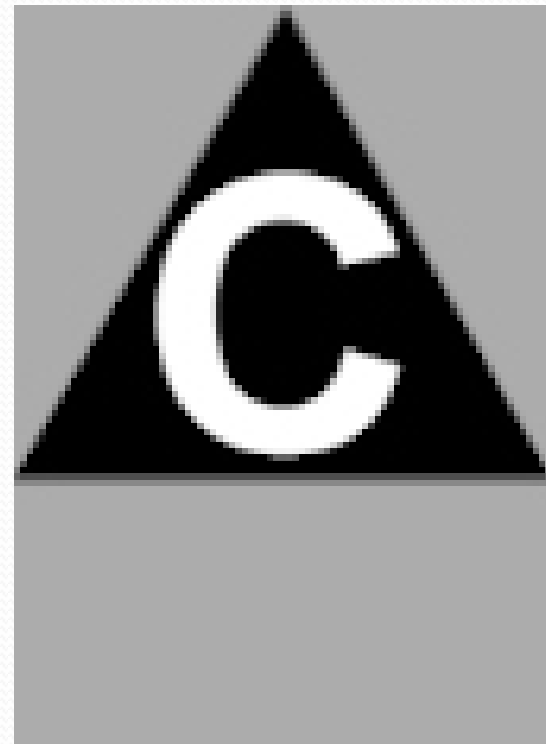
# Recycle

- Glass
- Paper
- Corrugated cardboard
- Aluminum
- X-ray film
- Reclaimed silver from X ray film
- Plastics

Bio-Hazard symbol



Cytotoxic Hazard symbol



# Landfill sites















**Thank you**