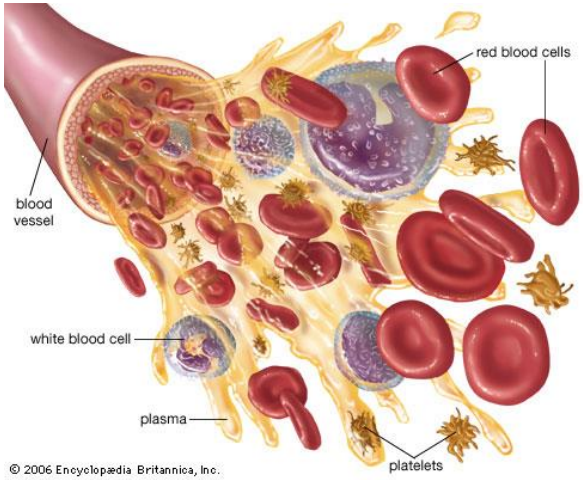

HOSPITAL
WASTE

MANAGEMENT


red blood cells
blood vessel
white blood cell
plasma
platelets
© 2006 Encyclopædia Britannica, Inc.

WASTES

WASTES

"Something which is not put into proper usage at a given time".

Wastes: are unwanted or unusable materials.

Definition of Bio-Medical Waste

- According to Bio-Medical Waste (Management & Handling) Rules 1998, of India, “Bio-Medical Waste” means
  - *Any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals, or in research activities pertaining thereto or in the production or testing of biologicals.*

- **Hospital waste:** refers to all waste, biological or non biological that is discarded and is not intended for future use.
- **Medical waste:** refers to material generated as a result of patient diagnosis, treatment, immunization of human being or animals.

- **Infectious waste:** are the portion of medical waste that could transmit an infectious disease.
- **Pathological waste:** waste removed during surgery, autopsy or other medical procedures including human tissues, organs, body parts, body fluids and specimen along their container.

Sources of health-care waste

- Hospitals- government & private
- Labs
- Dental clinics
- Medical Research & training centers
- Mortuaries
- Animal research
- Blood banks
- Slaughter houses
- Laboratories
- Vaccination centres

SOURCES OF BIO-MEDICAL WASTE

HOSPITALS, HEALTH CARE CENTERS

BLOOD BANKS

BIO TECHNOLOGICAL INSTITUTION

Laboratories

slaughter houses

Health care waste generation

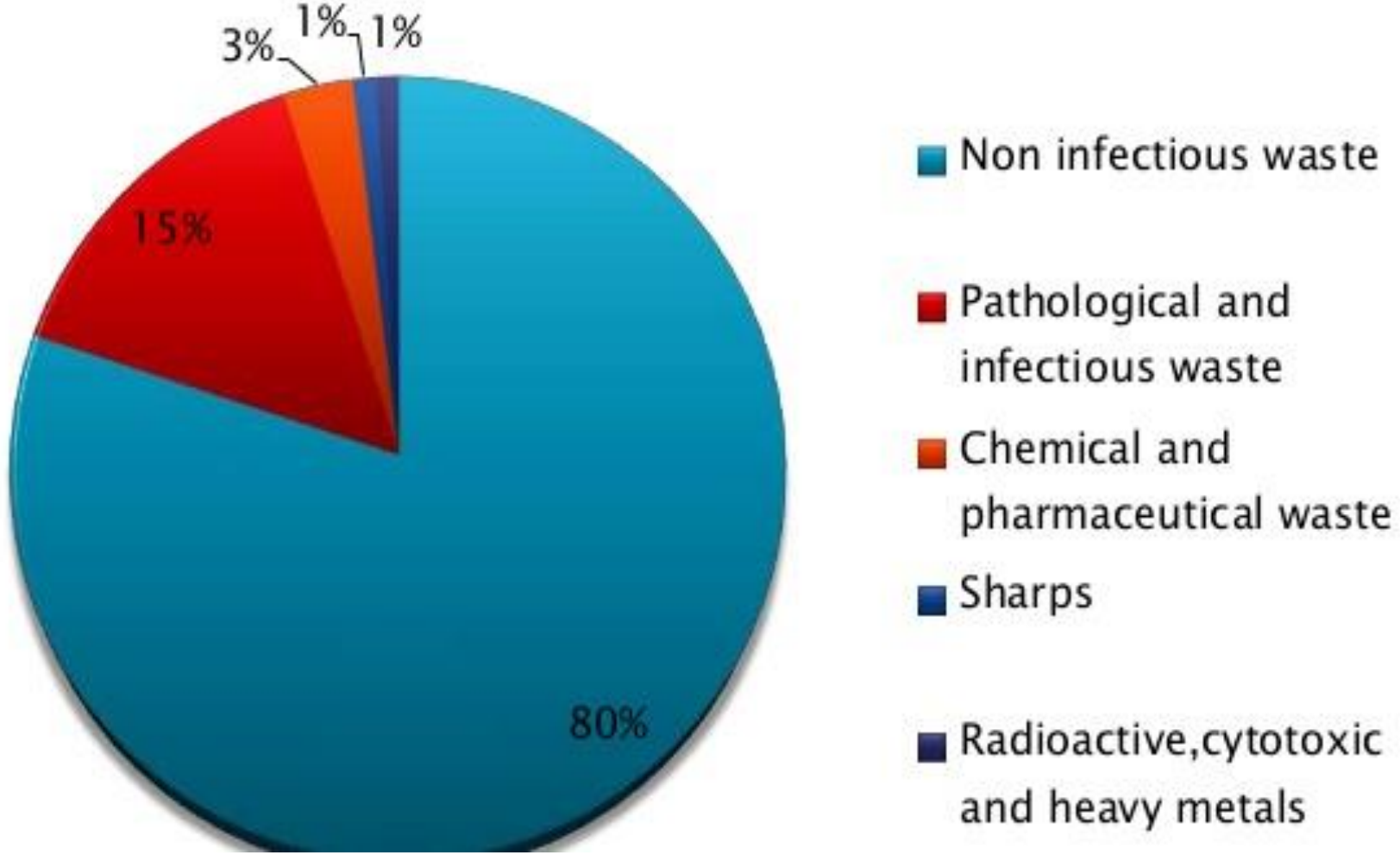
- waste generation vary from country to country & also within the country.
- *waste generation depends on factors like*

- Type of health-care establishment,
- Hospital specializations
- Proportion of reusable items
- Proportion of patients treated
- Established waste management methods

average distribution of healthcare wastes ….useful for planning

- 80 per cent general health-care waste, which may be dealt with by the normal domestic, and urban waste management system;
- 15 per cent pathological and infectious waste;
- 1 per cent sharps waste;
- 3 per cent chemical and pharmacological waste;
- Less than 1 per cent special waste, such as radio-active or cytotoxic waste, pressurized containers, or broken thermometers and used batteries.

Composition of biomedical waste



- *Survey done in Bangalore revealed – produces*

- ½ - 4 kg of waste per bed per day in Govt hospitals
- ½ - 2 kg of waste per bed per day in private hospitals
- ½ - 1 kg of waste in nursing homes
- Total quantity of hospital waste generated in Bangalore is about 40 tonnes/day. Of these only 40-50% is infectious.
- Only 30% of hospitals segregated the wastes

Health hazard of health-care waste

- hospitals generate large volumes of waste as a by-product of variety of health services & procedures like surgeries, wound dressings, dialysis, deliveries etc.
- This waste may be infectious or non infectious
- Is such waste is not collected & disposed properly l/t hazards.

Why we have to be careful with bio-medical waste???

- BMW contain infectious agents
- Contains toxic or hazardous chemicals, pathological waste,
- Contain sharps
- It is genotoxic
- It is radio-active

EFFECTS OF BIOMEDICAL WASTE

- The improper management of biomedical waste causes serious environmental problems in terms of

- Air,
- Water and
- Land pollution.

1. AIR POLLUTION:

- Air pollution can be caused in both indoors and outdoors.
- Biomedical waste that generates air pollution is of three types-
- Biological,
- Chemical and
- Radioactive.

A. Indoor air pollution:- Hospital Acquired Infections (Nosocomial infection).

- Indoor air pollution can caused due to: Poor ventilation ,Use of chemicals, disinfectants, fumigants etc.

B. Outdoor air pollution: can be caused by pathogens.

- When waste without pretreatment is being transported outside the institution, or if it is dumped openly, pathogens can enter the atmosphere i.e. drinking water, food stuff, soil etc.

2. WATER POLLUTION:

- Biomedical waste can cause water pollution.
- If the waste is dumped in low- lying areas, or into lakes and water bodies, can cause severe water pollution l/t epidemics of diarrhoeal diseases.
- Water pollution can be due to biological, chemicals or radioactive substances in bio-medical waste.


WARNING!
SEWERAGE
OUTLET

3. LAND POLLUTION:

- Open dumping of biomedical waste is the greatest cause for land pollution.
- Soil pollution from bio-medical waste is caused due to infectious waste, discarded medicines, chemicals.
- Heavy metals such as cadmium, lead, mercury, etc., which are present in the waste will get absorbed by plants and can then enter the food chain.

Groups at-risk are

- Doctors, nurses, health-care auxilliaries, hospital maintenance personnel
- Patients in hospital
- Visitors to hospital
- Workers in support service allied to health care like laundries, waste handing & transportation
- Workers in disposal facilities – land-fills, incinerators

Hazards from infectious waste & sharps

- Pathogen enters the human body through puncture, abrasion through inhalation or by ingestion
- E.g., Hepatitis B, C, HIV

Hazards from chemical & pharmaceutical waste

- Most of the chemicals are toxic, corrosive, flammable, geno-toxic

- **Hazards from genotoxic waste-**
- Depends on handling of waste, duration & extent of exposure to compounds,
- Exposure is by inhalation, absorption, ingestion of food accidentally contaminated with cyto-toxic drugs, chemical or wastes

- **Hazards from radio-active waste-** determined by type & duration of exposure. Mild to severe effects

- **Public sensitivity-** visual impact of health-care waste. like anatomical waste

Rules for BMW

- Government of India, first enacted an environment (Protection) act in 1986 notified the rules for the management & handling of bio-medical waste in July, 1998
- **As per these rules it is duty of occupier of….** hospital, Nursing home, clinic, dispensary, Veterinary institute, animal house, blood bank & pathological laboratory to take all steps to ensure that BMW is handled without adverse effect to human health & environment

- *AS PER NOTIFIED RULES……*
- BMW is not to be mixed with other wastes
- BMW should be segregated in specified Container / bag at the site of generation
- Each container has to be specifically labeled
- Transportation of such waste has to be done in specified vehicle only
- Untreated BMW is not to be stored beyond a period of 48 hours

OBJECTIVES OF HWM

- To reduce the infectious / hazardous nature of waste
- To prevent misuse of waste, Keeping the waste secured & preventing the access to unauthorized persons
- To ensure occupational safety & health
- To reuse & recycle items that can be of repeated utility.
- Initiate awareness campaigns about the potential hazard of medical waste within the health care setup & community.

Major salient features of BMW management rules 2016

- Rules expanded to vaccination camps, surgical camps
- Pretreatment of laboratory & microbiological waste,
- Training to all health care workers & immunize all health care workers regularly
- BMW classified into 4 categories instead of 10 categories
- Improving standards of incinerators
- State governments to provide land for common BMW treatment & disposal facility

These rules consist of 4 schedules & 5 forms

- **Schedule 1:** Categories, segregation, collection, treatment, disposal options of BMW
- **Schedule 2:** standards for treatment & disposal of BMW
- Operating, emitting standards, standards for autoclaving, microwaving, deep burial, chemical disinfection.
- **Schedule 3 :** list of prescribed authorities & their corresponding duties
- **Schedule 4:** part A- label for BMW containers

  part B- label for transporting BMW bags

- 5 forms are

1. Accident reporting
2. Application for authorization or renewal of authorization
3. Authorization
4. Annual report
5. Application for filing appeal against order passed by prescribing authority.

Schedule 1 categories of bio-medical waste

WASTE CATEGORIES	TYPES OF WASTE
Category no. 1	Human anatomical waste(Human tissues, organs, body parts)
Category no. 2	Animal Waste(Animal tissues, organs, body parts, carcasses, bleeding parts, fluid, blood)
Category no. 3	Microbiological and biotechnological waste(Wastes from laboratory cultures, stocks or specimen of organism)
Category no. 4	Waste sharps(Needles, syringes, scalpels, blades, glass, etc. that may cause puncture and cuts)
Category no. 5	Discarded medicine, cytotoxic waste(Wastes comprising of outdated, contaminated, discarded medicines)
Category no. 6	Soiled waste(Items contaminated with body fluids including cotton, dressings, soiled plaster casts)
Category no. 7	Solid waste(Waste generated from disposable items as tubing, catheters, intravenous set)
Category no. 8	Liquid waste(Waste generated from the laboratory and washing, cleaning)
Category no. 9	Incineration waste(Ash from incineration of any biomedical waste)
Category no. 10	Chemical waste(Chemicals used in production of biological, chemicals used in disinfecting)

New categories

category	colour	Type of waste
1	Yellow	- **Human anatomical waste-** tissues, organs, foetus below viability **- Animal anatomical waste** -**Soiled waste-** items contaminated with blood, body fluids like dressings, plaster cast, cotton swab, discarded blood bags -- **Expired or discarded medicines-** antibiotics, Cytotoxic drugs including all items contaminated with Cytotoxic drugs along with glass or plastic ampoules, vials etc

category	colour	Type of waste
1	Yellow	**- Chemical waste-** chemicals in production of biologicals - **Chemical liquid waste** - **Discarded linen, mattresses, beddings** contaminated with blood or body fluids - **Microbiology, biotechnology & other chemical lab. waste**

category	colour	Type of waste
2	Red (recyclable)	Contaminated waste Disposal items like tubings, IV tubes, catheters, saline bottles, urine bags, syringes without needles & gloves
3	White translucent	needles, syringes with fixed needles, scalpels, blades, other sharp objects
4	Blue	a. Glass ware- broken or contaminated glass including medicine vials & ampoules except those contaminated with cytotoxic waste b. metallic body implants

STEPS IN THE MANAGEMENT OF BIOMEDICAL WASTE:-

Survey of waste generated

- A survey of waste generated in different health care settings (waste survey) is basic prerequisite for planning & implementation of a waste management endeavor k/as "WASTE AUDIT".
- *Differentiate the types of waste*
- *Quantity of waste generated*
- *Determine the point of generation & type of waste generated at each point*
- *Determine the disinfection facilities in the hospital*

Segregation

- It refers to the basic separation of different category of waste generated at source and thereby reducing the risks as well as cost of handling and disposal.
- Segregation is the most crucial step in BMW management.
- Effective segregation alone can ensure effective BMW management.
- If segregation not done properly l/t serious health risks

Collection of BMW

- waste should be collected & stored in thick, noncorrosive, disposal plastic bags, kept in plastic container covered with lid.
- The containers should be placed in all departments, corridors, public utilities, in such a way that 100% collection is achieved.
- Sharps must always be kept in puncture proof containers to avoid injuries and infection to the waste handlers.
- BMW should be handled properly by using universal precautions to prevent from any kind of infection.

Segregation & collection of bio-medical waste

Cat.	Type of Bag/ Container used	TYPE OF WASTE	Treatment /Disposal options
Yellow 	non-chlorinated plastic bags Separate collection system leading to effluent treatment system ←	**a) Human Anatomical Waste** **b) Animal Anatomical Waste** **c) Soiled Waste** **d) Expired or Discarded Medicines** **e) Chemical Waste** **f) Micro, Bio-t and other clinical lab waste** **g) Chemical Liquid Waste**	Incineration or Plasma Pyrolysis or deep burial*
Red 	non-chlorinated plastic bags or containers	**Contaminated Waste (Recyclable)** tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles) and gloves.	Auto/ Micro/Hydro and then sent for recycling. not be sent to landfill
White 	(Translucent) Puncture, Leak, tamper proof containers	**Waste sharps including Metals**	Auto or Dry Heat Sterilization followed by shredding or mutilation or encapsulation
Blue 	Cardboard boxes with blue colored marking	**Glassware**	Disinfection or auto/ Micro/hydro and then sent for recycling.

Storage

- Once collection occurs then biomedical waste is stored in proper place.
- Segregated waste of different categories need to be collected in identifiable containers.
- The duration of storage should not exceed 8-10 hours in big hospitals and 24 hours in nursing homes.
- Each container should be clearly labeled to show the ward where it is kept.

Labeling of containers

- The bins and bags should carry the biohazard symbol indicating the nature of waste to the patient and public.
- Labels shall be non washable and prominently visible.

Labeling for transportation of bags

Schedule – IV
Label for Transportation of Bio-Medical Waste Containers/ Bags

- Waste Category No.
- Waste Class
- Waste Description

Day ..... Month .....
Year .....
Date of Generation .....

Sender's Name and Address

- Phone No. .....
- Telex No. .....
- Fax No. .....
- Contact Person .....

Receiver's Name and Address
Phone No. .....
Telex No. .....
Fax No. .....
Contact Person .....

In Case of Emergency, Please Contact

- Name & Address
- Phone No.

Transportation

- Transportation devices- Trolleys
- Manual loading should be avoided as far as possible.
- The containers should be tied before transportation.
- Container should be accompanied with a signed document by nurse/doctors mentioning date , shift ,quantity and destination.

COLLECTION, TRANSPORTATION, STORAGE (WITHIN THE HOSPITAL)

Transportation

5 Ways of Treating Medical Waste

Incineration

Typically for pathological waste and pharmaceutical waste. Never for plastics.

Non-Incineration Systems

Thermal
(Autoclaving)

Typically for sharps waste and infectious waste.Never for pathological waste.

Irradiative
(Microwave)

Typically for sharps waste and infectious waste.Never for pathological waste.

Chemical

Typically for chemical waste and liquid waste (e.g. generated from laboratory cleaning).

Biological
(Enzymes)

Undeveloped and rarely used technology for medical waste disposal.

Properly Disposing Of Your Medical Waste Prevents Infections and Diseases From Spreading, And

Keeps Our Earth Clean.

Treatment & disposal technologies for health care waste

1. Incineration:

- High temperature (1000 deg. C)dry oxidation process that reduces organic & combustible waste into inorganic, incombustible matter & reduction of waste volume & weight.
- Used for those items that are cannot be recycled or reused.
- Don’t require pre-treatment.

- **Characteristics of waste suitable for incineration-**

- Low heating volume
- Content of combustible matter >60%
- Content of non-combustible solids <5%
- Content of non-combustible fines <20%
- Moisture content <30%

- waste types not to be incinerated are

- Pressurized gas containers
- Large amount of reactive chemical waste
- Silver salts & photographic or radiographic waste
- Halogenated plastics like PVC
- Waste with high mercury or cadmium content like broken thermometers, used batteries, lead-lined wooden panels
- Sealed ampoules or ampoules with heavy metals

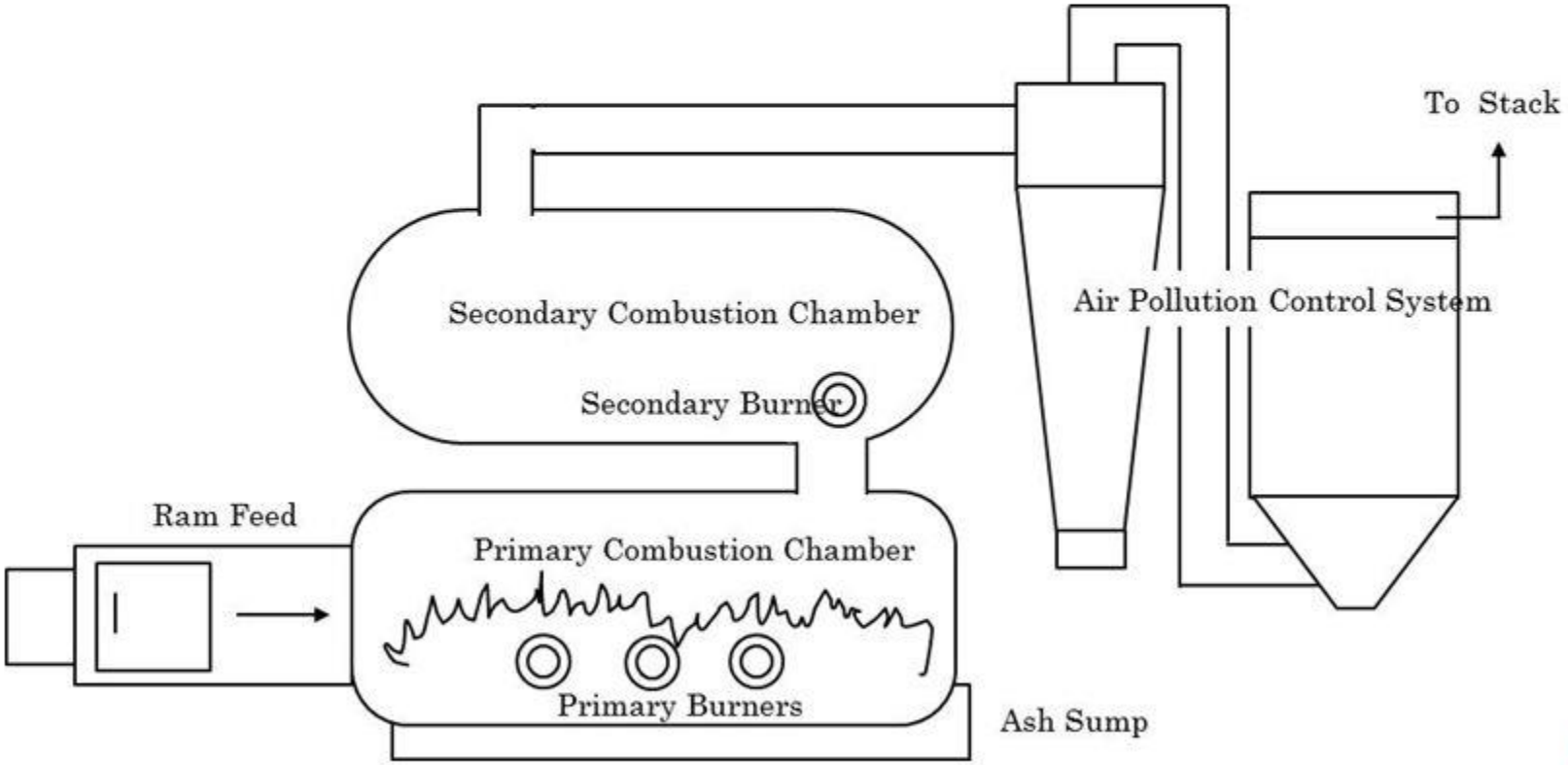
Types of incinerators

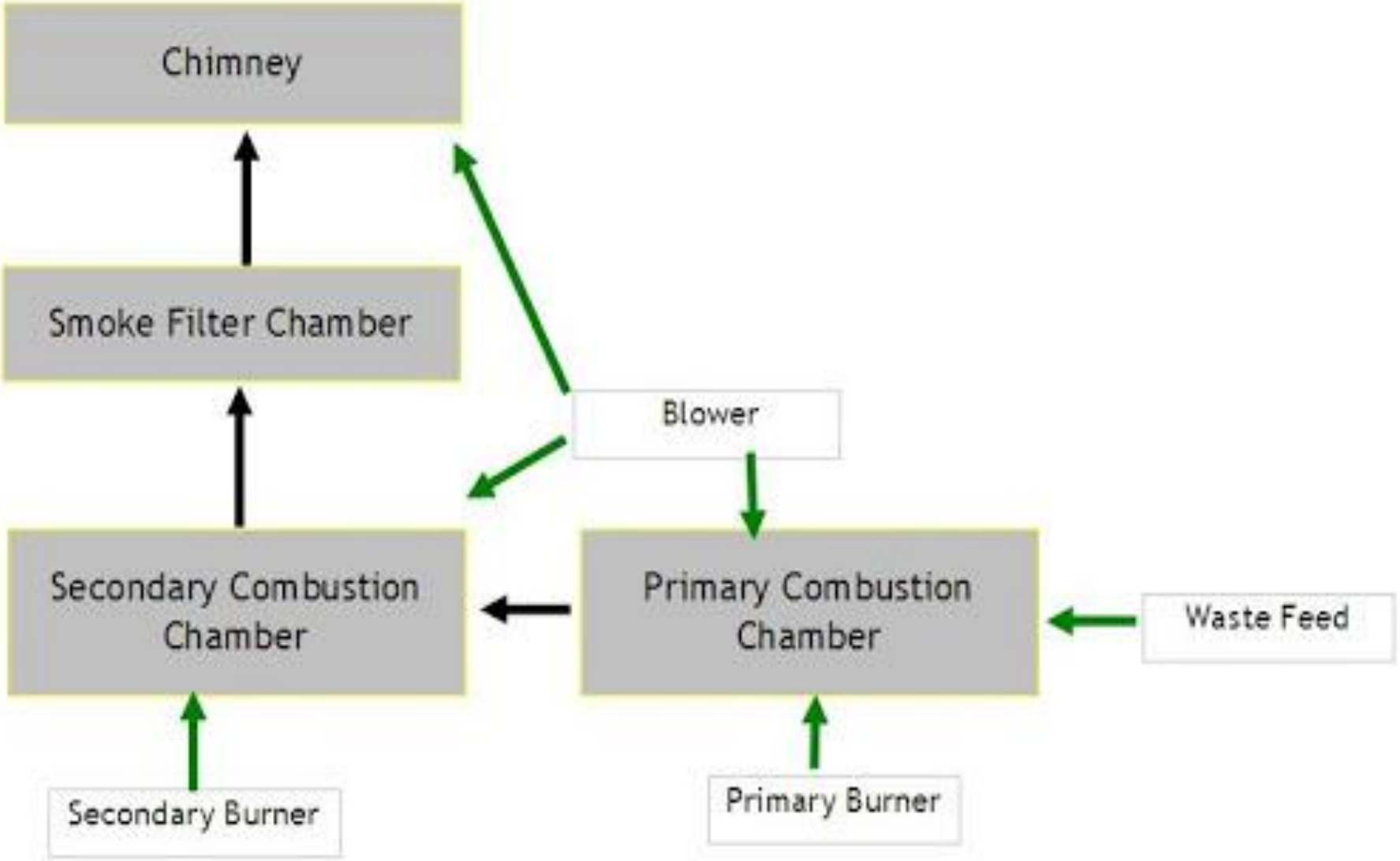
- Chosen on the basis of available resources, local situation & risk-benefit analysis.
- 3 basic kinds are used.
- Double-chamber pyrolytic incinerators- infectious health care waste,
- Single chamber furnaces- if not affordable
- Rotary kilns at high temperatures, capable of causing decomposition of genotoxic substances

- Double-chamber pyrolytic incinerators: eco-friendly technology
- used to burn infectious health care waste, at temp. b/n 900-1200 deg. C & this has pollution control devices.
- This has computer recording devices which will automatically & continuously monitor & record dates, time of day, operating parameters like temperature, emissions of CO, CO2, O2 periodically.

Types of Incinerators for Healthcare Waste

– Dual-chamber incinerator




Chimney
Smoke Filter Chamber
Blower
Secondary Combustion Chamber
Primary Combustion Chamber
Waste Feed
Secondary Burner
Primary Burner

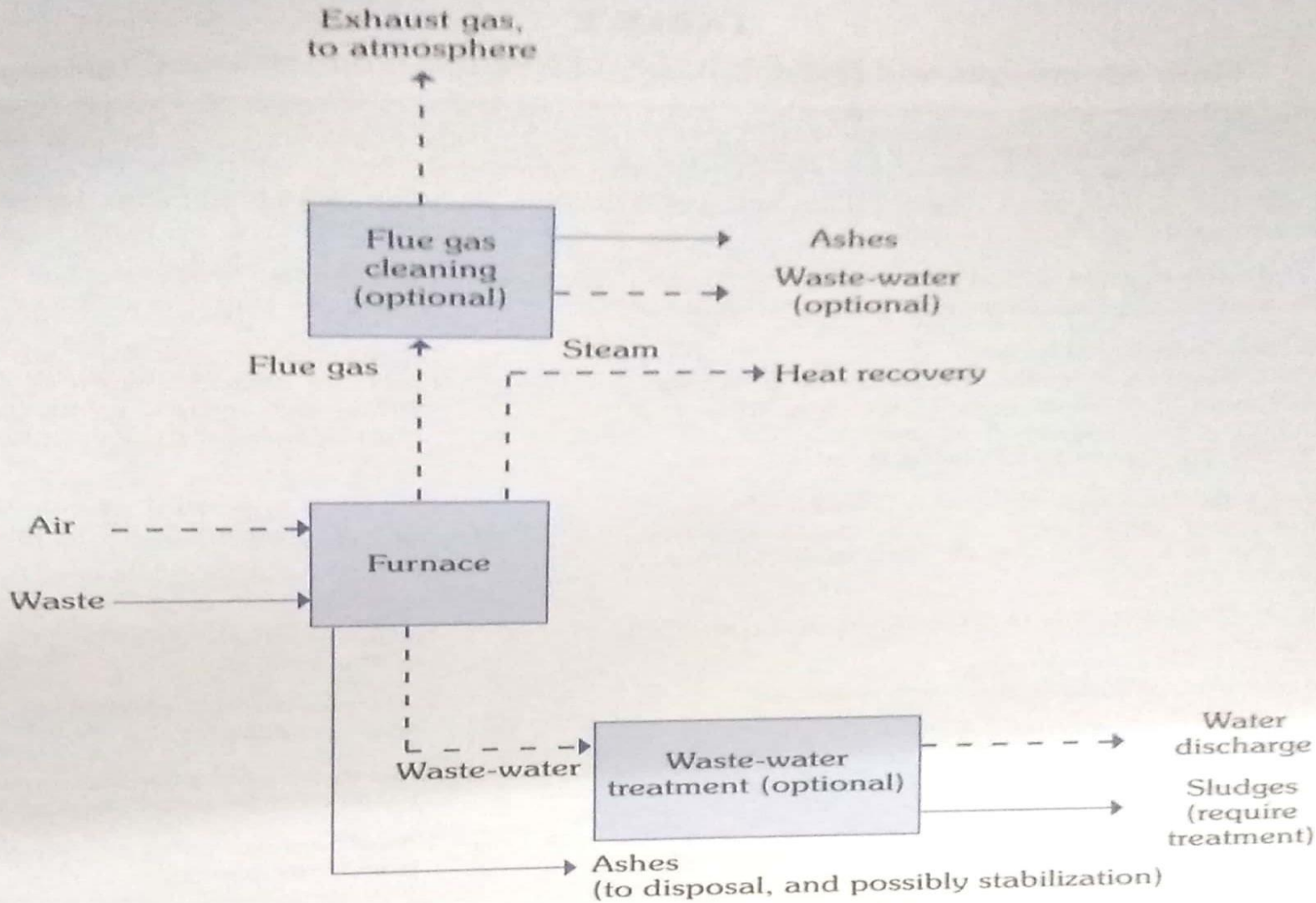
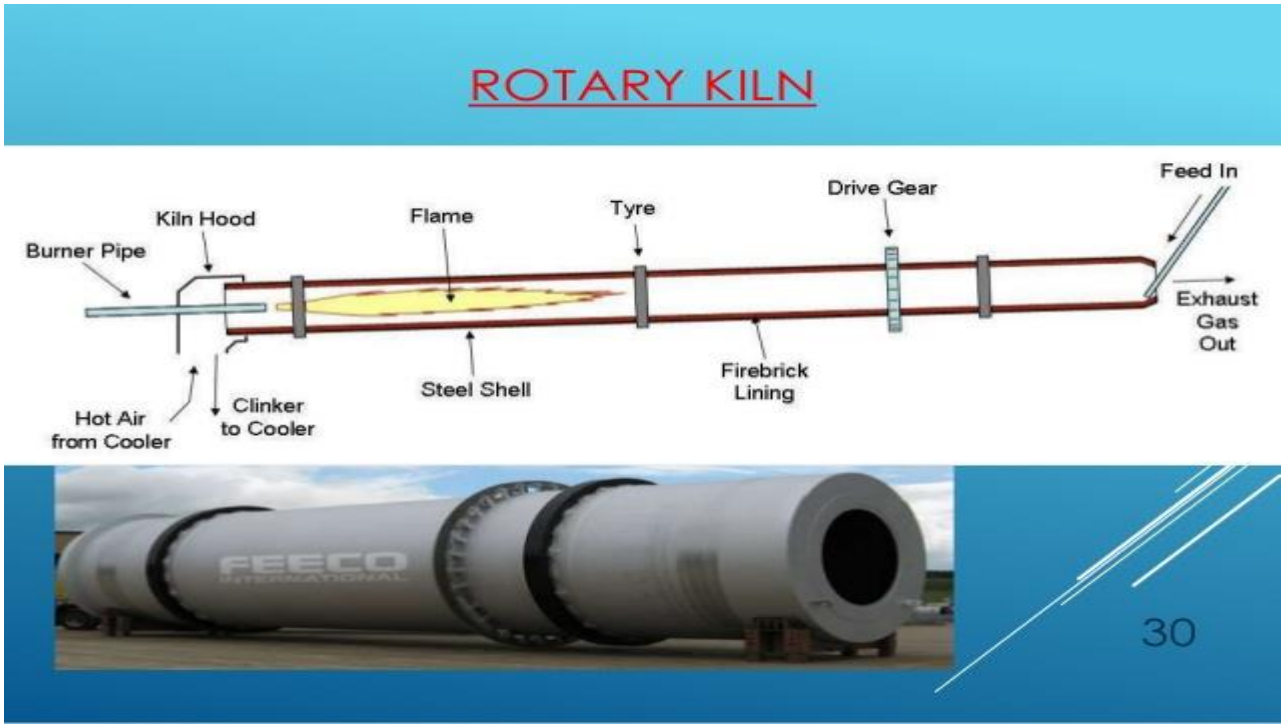


FIG. 1
Simplified flow scheme of incinerator

efficiency of the microwave disinfection shou
routinely through bacteriological and virologi

- Rotary kiln incinerator- burn waste like sharps & infectious waste at 200-1600 deg. C



Chemical disinfection

- Chemicals disinfectants like bleaching powder, gluteraldehyde, alcohols or quaternary ammonium compounds are added to kill or inactivate pathogens in waste.
- Effectiveness of chemical disinfectant: depends on factors like concentration, stability of chemicals, surface contact time.
- Suitable for liquid waste like blood, urine, stools, hospital sewage

Wet & dry thermal treatments

- Wet thermal treatments / steam disinfection:

- Exposure to high temperature, high pressure steam & is similar to autoclave

- Screw-feed technology- non-burn, dry thermal disinfection process. Waste is reduced by 80% in volume & by 20-35% in weight. Suitable for sharps

Microwave irradiation

- Pathogens are destroyed by action of microwave of a frequency of 2450 MHz & at a wave length of 12.24nm, destroyed by heat conduction.
- **Adv-** high efficacy, 30-40% volume reduction, no harmful emissions, minimal environmental pollution & occupational risk, cost-effectiveness.

Land disposal

- Municipal disposal sites- 2 types
- open- dumps & sanitary land-fills
- **open- dumps -** Risk either people or animal coming into contact with infectious pathogens
- Indiscriminate dumping of hospital waste into municipal sites become breeding places for flies, mosquitoes, rodents etc l/t spread of arthropod borne diseases.

- sanitary land-fills- scientifically designed.
- **Advantages:** geological isolation of waste from environment, appropriate engineering preparation before the site is ready to accept waste, staff present on-site to control operations, organized deposit & daily coverage of waste

Inertization

- Involves mixing waste with cement & other substances before disposal on order to minimize the risk of toxic substances contained in wastes migrating into surface or ground water
- E.g., 65% pharmaceutical waste + 15% lime + 5% water → homogenous mass
- Cubes or pellets are produced from these mass & then transported to suitable storage sites

Other methods

- Plasma torch technology-
- Hydroclave – advanced autoclave method utilizing steam
- Shredding- reduction in volume of waste

Advantages & disadvantages of treatment & disposal options

Disposal method	Advantages	Disadvantages
Rotary kiln	Adequate for all infectious waste, chemical waste, pharmaceutical waste.	High investment & operating cost.
Pyrolytic incineration	High disinfection efficacy, adequate for all infectious waste, chemical waste, pharmaceutical waste.	Incomplete destruction of Cytotoxic. High investment & operating cost.
Single-chambered incineration	Good disinfection efficacy, drastic reduction of weight & volume, no need for trained persons, low investment & operating cost.	Emissions of atmospheric pollutants. Need for periodical removal of slag & soot. Inefficiency in destroying thermally resistant chemicals & cytotoxics.

Disposal method	Advantages	Disadvantages
Chemical disinfection	Highly efficient under good operating conditions. Some chemicals are inexpensive	Require highly qualified technicians for operation of process, require safety measures to workers,
Wet thermal treatment	Environmentally sound, low operating cost	Require highly qualified technicians . Not suitable anatomical, pharmaceutical waste
Microwave irradiation	Good efficiency under appropriate operating conditions. drastic reduction of weight & volume, environmentally sound	High investment & operating cost.
Safe burying	Low cost.	Safe if access is restricted to public
Inertization	Inexpensive relatively	Not useful for infectious waste

summary

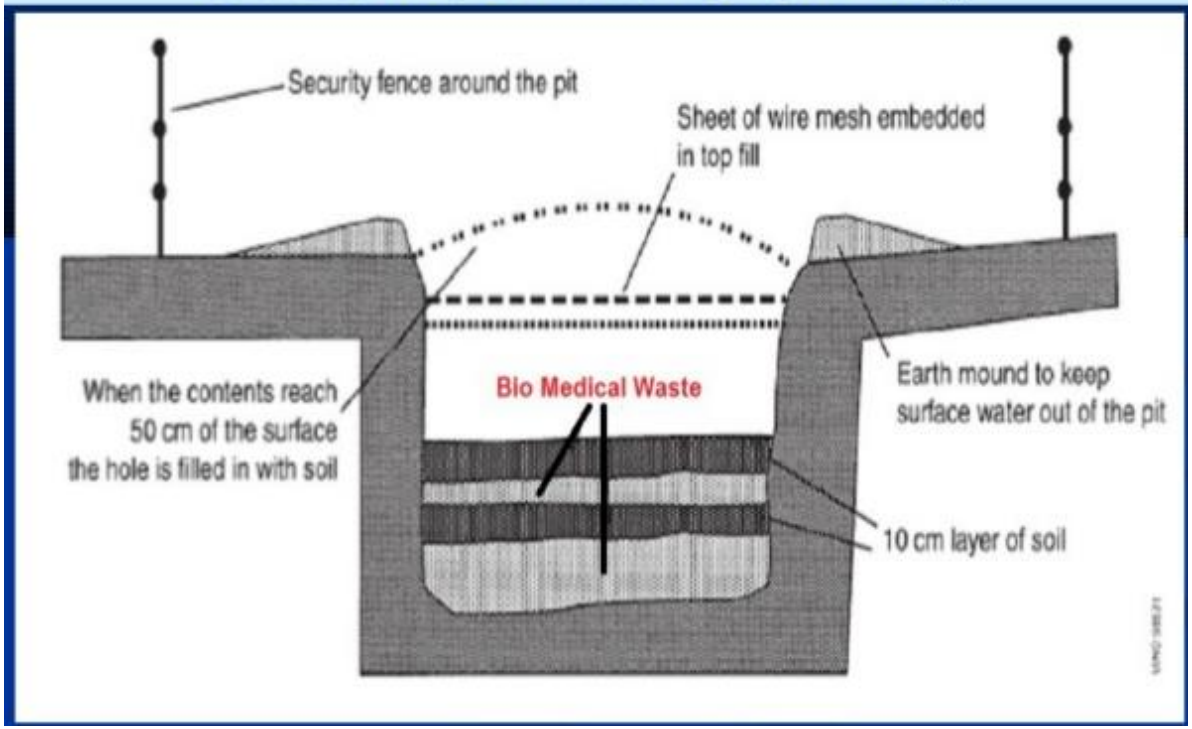
- Hospital waste is infectious
- Use personal protective devices while handling waste
- Segregate the waste at the production itself
- Educate hospital staff on problems with health care waste & use for color coded bags effectively.

Safe management practices

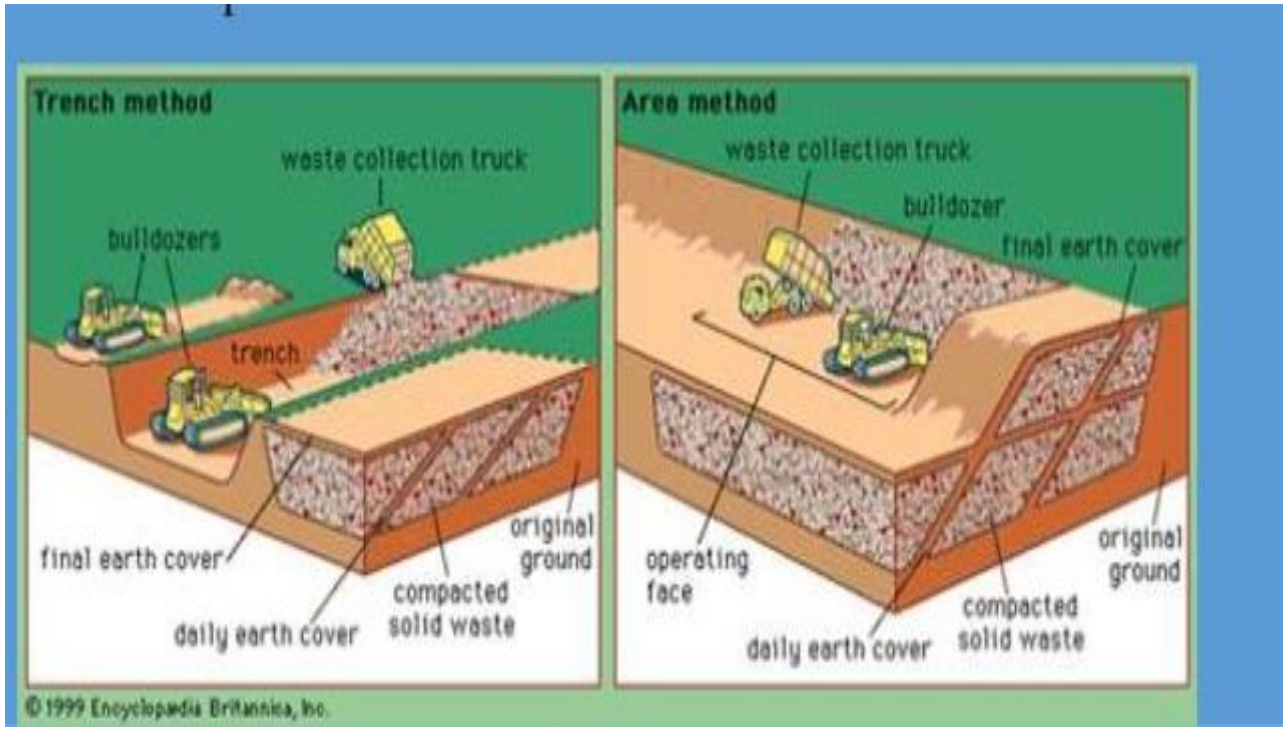
- to maintain cleanliness in the hospital
- To maintain healthy environment for patients, staff & public
- To prevent spread of infectious diseases
- To attract more patients, → incr. in revenue for institution.

HANDLE WITH CARE

DEEP BURIAL PIT for BMW



Sanitary land fill



Cat.	Type of Bag/ Container used	TYPE OF WASTE	Treatment /Disposal options
Yellow 	non-chlorinated plastic bags Separate collection system leading to effluent treatment system ←	**a) Human Anatomical Waste** **b) Animal Anatomical Waste** **c) Soiled Waste** **d) Expired or Discarded Medicines** **e) Chemical Waste** **f) Micro, Bio-t and other clinical lab waste** **g) Chemical Liquid Waste**	Incineration or Plasma Pyrolysis or deep burial*
Red 	non-chlorinated plastic bags or containers	**Contaminated Waste (Recyclable)** tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles) and gloves.	Auto/ Micro/Hydro and then sent for recycling. not be sent to landfill
White 	(Translucent) Puncture, Leak, tamper proof containers	**Waste sharps including Metals**	Auto or Dry Heat Sterilization followed by shredding or mutilation or encapsulation
Blue 	Cardboard boxes with blue colored marking	**Glassware**	Disinfection or auto/ Micro/hydro and then sent for recycling.

- What is the color coding of the bag used in hospitals to dispose off human anatomical wastes such as body parts:
  A. Yellow
  B. Black
  C. Red
  D. Blue
- Scalpels to be disposed in which color bin ____
- (white)

- Which is not a biomedical waste

a. Tissue culture
b. Cadavers
c. Body fluids & tissues
d. catheters

- After giving Intra muscular injection to patient where to dispose syringe, needle, cotton??

- Don’t replace cap
- Use hub cutter to cut needle
- Place syringe in red color bin
- Cotton in yellow color bin
- Vial or ampoule if not contaminated with cytotoxic drugs keep it in blue bin
- If contaminated with cytotoxic drugs.. Use yellow bin

THANK YOU