

# AN INTRODUCTION TO ESSENTIALS OF BIO-MEDICAL WASTE MANAGEMENT

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## ABSTRACT

The issue of biomedical waste management has assumed great significance in recent times particularly in view of the rapid upsurge of HIV infection. Government of India has made proper handling and disposal of this category of waste a statutory requirement with the publication of gazette notification no 460 dated 27 July 1998. The provisions are equally applicable to our service hospitals and hence there is a need for all the service medical, dental, nursing officers, other paramedical staff and safaiwalas to be well aware of the basic principles of handling, treatment and disposal of biomedical waste. The present article deals with such basic issues as definition, categories and principles of handling and disposal of biomedical waste.

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KEY WORDS :Bio-medical waste; Hospital infections; Hospital waste disposal.

## Introduction

The subject of biomedical waste management and handling has been assuming increasing significance for the past few years. The responsibility of medical administrators as regards proper handling and disposal of this category of waste has now become a statutory requirement with the promulgation of Government of India (Min of Environment and Forests) gazette notification no. 460 dated 27 Jul 1998 [1]. The provisions of the gazette are also applicable to Armed Forces hospitals. The present system of biomedical waste disposal system in Armed Forces is far from satisfactory [2]. It is therefore highly desirable that all service officers concerned with the administration of hospitals and other health care echelons take all steps to adhere to the laid down directives. It is equally important that all service medical, dental, nursing officers, other paramedical staff and waste handlers such as safaiwalas be well oriented to the basic requirements of handling and management of biomedical waste. It is with this objective of providing such basic information that the present article has been composed.

## Definition

Biomedical waste is defined as any waste, which is generated during the diagnosis, treatment or immunisation of human beings or animals, or in research activities pertaining thereto, or in the production or testing of biologicals [1].

## Categories of Biomedical Waste

There are ten defined categories (category code Nos 1 to 10) as follows [1&3].

1. Human anatomical waste : (tissues, organs, body parts)
2. Animal waste : (including animals used in research and waste originating from veterinary hospitals and animal houses).
3. Microbiological and biotechnology waste : (including waste from lab cultures, stocks or specimens of microorganisms, live or attenuated vaccines, wastes from production of biologicals, etc.)
4. Waste sharps : (used/unused needles, syringes, lancets, scalpels, blades, glass etc.)
5. Discarded medicines and cytotoxic drugs.
6. Soiled wastes : (items contaminated with blood and body fluids, including cotton dressings, linen, plaster casts, bedding etc.)
7. Solid wastes : (wastes generated from disposable items other than waste sharps such as tubing, catheters, i.v. sets, etc.)
8. Liquid waste : (waste generated from washing, cleaning, house keeping and disinfection activities including these activities in labs).
9. Incineration ash : (from incineration of any biomedical waste)
10. Chemical waste : (chemicals used in production of biologicals and disinfection).

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### Quantum of waste

The quantity of biomedical waste generated per bed per day will vary depending upon the type of health problems, the type of care provided and the hospital waste management practices. It varies from 1-2 kg in developing countries to 4.5 kg in developed countries such as USA [3,4]. 10-15% of the waste is infectious in developed countries whereas it varies from 45.5 to 50% in India, requiring special handling [4]. Infective waste was found to be only 6% at Command Hospital (Air Force) Bangalore [5].

### Hazards

The following properties of biomedical waste make it hazardous [6]:-

- a. Infectious
- b. Injurious
- c. Cytotoxic
- d. Chemical

Biomedical waste is hazardous since it has an inherent potential for dissemination of infection, both nosocomial within health care settings as well as risk of infection to persons working outside health care facilities, like waste handlers, scavenging staff and also to the general public. It is reported that 60% of all hospital staff sustain injuries from sharps during various procedures undertaken in health care facilities [7]. Cytotoxic and chemical waste is mutagenic and / or teratogenic [8]. Additional hazard includes recycling of disposables without being even washed [3].

### Schedule for Waste Treatment Facilities

The schedule for complete establishment of waste treatment facilities is as follows:-[1]

- A. Hospitals in towns with a population of 30 lakhs and above : By 30 Jun 2000 or earlier.
- B. Hospitals in towns with population below 30 lakhs.
  - i. With 500 beds and above : By 30 Jun 2000
  - ii. With 200 to 499 beds : 31 Dec 2000 or earlier
  - iii. With 50 to 199 beds : 31 Dec 2001 or earlier
  - iv. With less than 50 beds : 31 Dec 2002 or earlier
- C. All other institutions generating bio-medical waste not included in A and B above by 31 Dec 2002 or earlier.

### Principles of bio-medical waste management

The principles of biomedical waste management are as follows:-

- a. General principles of hygiene and sanitation.  
Observance of general principles of hygiene and

sanitation such as cleanliness, good house keeping, adequate supply of safe water, sanitary facilities and proper ventilation are essential components of a good bio-medical waste management plan.

#### b. Waste minimization

It is essential that every waste generated from the hospital should be identified and quantified. Hospitals should endeavour to reduce waste by controlling inventory, wastage of consumable items and breakages etc. Waste can also be minimized by recycling certain waste such as glassware, plastic material etc after proper cleaning and disinfection.

#### c. Waste segregation

Segregation of waste at source and safe storage is the key to whole hospital waste management process. Segregation of various types of wastes into different categories according to their treatment/disposal options should be done at the point of generation in colour coded plastic bags/containers as per schedule II of the gazette notification. The needles and syringes should be disinfected and mutilated before segregation. The type of containers and their colour codes as stipulated in Govt of India notification are given in Table - 1.

TABLE 1  
Category and colour code of waste disposal system

Waste category	Type of container	Colour code
1,2,3 and 6	Plastic bags	Yellow
3,6 and 7	Disinfected container/ plastic bag	Red
4 and 7	Puncture proof container/ plastic bags	Blue/white translucent
5,9 and 10 (solids)	Plastic bags	Black

#### Notes :

- Colour coding of waste categories with multiple treatment options as defined in schedule I, shall be selected depending on treatment option chosen
- Waste collection bags should not be made of chlorinated plastics
- Categories 8 and 10 (liquid) do not require container/bags
- Category 3 if disinfected locally need not be put in containers/bags

#### d. Waste treatment on site

Microbiological and biotechnology waste being highly infectious should be treated on site by autoclaving/microwaving/chemical treatment. The guidelines for chemical disinfection of different categories of biomedical wastes are shown in Table 2,3 [3,9].

#### e. Waste transportation

The waste should be transported to kerb collection area in covered container. All containers should have biohazard label according to schedule III of



TABLE 2

**Chemical disinfection**

A. Chlorine releasing compounds (used for disinfection of materials contaminated with blood and body fluids)

Name of disinfectant	Available chlorine	Required chlorine	Contact period	Amount of disinfectant to be dissolved in 1 litre of water
Sodium hypochlorite	5%	0.5%	30 minutes	100 ml
Calcium hypochlorite	70%	0.5%	30 minutes	7.0 g
NaOCl powder (Sodium dichlorosocyanurate)	—	0.5%	30 minutes	8.5 g
NaOCl tablets	—	0.5%	30 minutes	4 tablets
Chloramine	25%	0.5%	30 minutes	20 g

TABLE 3

**Chemical disinfection**

B. Non-chlorine releasing compounds (used for disinfection of items which are adversely affected upon by chlorine)

Name of disinfectant	Required concentration	Contact period	Used for disinfection of
Ethanol	70%	3-5 min	Smooth metal surfaces, table tops, incubators, thermometers
Alkaline Glutaraldehyde	2%	30 min	Ambu bags, suction tubes/ bottles, laryngoscopes, endotracheal tubes, catheters, etc.
Formaldehyde/ formalin	3-4%	30 min	Furniture, rooms, walls, blankets, beds, books, etc.
Savlon	1%	30 min	Cheatele forceps
Dettol (Chloroxylenol)	5%	15 min	Instruments and plastic equipment
Cresol	2.5 - 5%	30 min	All purpose disinfectant

the gazette notification. If a container is transported from the premises where biomedical waste is generated to any waste treatment facility outside the premises, the container shall, apart from the label prescribed in schedule III also carry information prescribed in schedule IV. The containers and the vehicles used for transportation of biomedical waste should not be used for any other purpose. Care should be taken to avoid spills.

f. Waste treatment off site.

The various final treatment options available are :-

- i. Incinerator
- ii. Microwave
- iii. Autoclave
- iv. Hydroclave
- v. Plasma torch technology
- vi. Medical waste sterilization unit

All the above systems have certain limitations. Heavy metals and plastic cannot be burnt in incinerators. Microwave cannot take up large pieces of metals and body parts for disinfection. The autoclave does not reduce the volume and may increase the weight of the waste due to moisture. Plasma Torch Technology is prohibitively expensive. Hydroclaves are comparatively cheap to run but not suitable for large body parts. Hence one has to look for multiple options instead of basing the waste treatment system only on one option.

g. Final disposal

The various disposal options after treatment are incineration, secured landfill, vermicomposting and public sewers. Biomedical waste should be treated and disposed off finally in accordance with schedule I of the rules and the prescribed standards given in schedule V of Govt of India gazette notification by one of the following methods :-

- i. Chemical treatment - sharps, solid, liquid and chemical wastes
- ii. Autoclaving/Microwaving - microbiology/biotechnology, sharps, soiled and solid wastes.
- iii. Incineration - human, animal, microbiology/biotechnology and solid waste.
- iv. Deep burial in secured landfills - discarded medicines, incineration ash and chemical solid waste such as mercury.
- v. Drainage - liquid waste, chemical liquid waste, cytotoxic waste in addition to being toxic are mutagenic hence should never be diluted and discharged into the sewers [8].

*Storage of waste pending final disposal*

The following points need to be considered :-

- i. Do not store waste beyond a period of 48 hours.
- ii Bins can be of metal or plastic.
- iii. If bins are re-usable, ensure their cleaning and disinfection.
- iv. Containers should not be too large as they may be difficult to lift and there can be spillage.
- v. Each receptacle should be properly marked to show the ward or section where it is kept.
- vi. Bins preferably should be inner lined with polythene bags and provided with lids.
- vii. Move bins atleast once a day from all areas, twice or more from OTs, ICUs.
- viii. Bags for wastes needing incineration should not be made of chlorinated plastic.

- ix. Categories 8 and 10 (liquid waste) need not be put in containers.
- x. Category 3 if disinfected locally need not be put into containers.
- xi. Polythene bags carrying waste should be sealed/tied at the top whenever waste is being transported within or outside the hospital.
- xii. Disposable items should be shredded or mutilated to prevent reuse. Subsequently, they should be disinfected/disposed off as per guidelines.
- xiii. Bins or polythene bags placed in the containers to be changed with each shift or when they are 3/4 full. At this point, they should be treated with suitable chemical disinfectant, collected in proper plastic bags from various wards and sections, and then despatched to the final disposal site as stipulated.

#### *Maintenance of Records*

All hospitals should maintain records regarding quantity and category of all biomedical waste, which are subject to inspection and verification by the Govt prescribed authority at any time.

#### *Annual Report*

Every hospital is required to submit an annual report as per prescribed proforma by 31 January every year regarding the quantity and category of waste handled during the preceding year to the prescribed authority who in turn will forward a consolidated report to Central Pollution Control Board of the state by 31 March every year.

#### *Accident Reporting*

When any accident occurs while handling or transportation of waste, the authorised person shall report the accident in prescribed form to the authority forthwith.

#### *Training of personnel*

The objectives of a waste management scheme should be to change a mind set through training [10]. Standard training modules/manuals for doctors, nursing staff, lab technicians, ward attendants, safaiwalas, patients and their attendants should be developed to create awareness and ensure efficient handling and management of biomedical waste [11].

#### *Evaluation*

Ongoing evaluation of the biomedical waste management programme in the hospital is very important to identify bottlenecks and to take remedial action. It is suggested that Hospital Infection Control Commit-

tee (HICCOM) should specifically look into this aspect.

Consequent to the gazette notification, it is now mandatory for all health care facilities to have sound bio-medical waste management and handling facilities as per prescribed standards and schedules. It may not be possible to achieve all the standards in one go. An incremental approach, which has been suggested by the WHO, is the best strategy [2]. The aim should be to make improvements and gradually move towards a sustainable system in order to achieve a healthier environment, mind and body. It is time that our service hospitals, which are eminently known for their high standards of hygiene, good maintenance and excellent administration, should take a lead in this vital area of health care.

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