

BMW Health Hazard

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Abstract: *Biomedical waste (BMW) or Hospital waste is generated during the diagnosis, treatment immunization of human beings or animals. It may include wastes like sharps, soiled waste, disposables, anatomical waste, cultures, discarded medicines, chemical wastes, etc. These are in the form of disposable syringes, swabs, bandages, body fluids, human excreta, etc. This waste is highly infectious and can be a serious threat to human health if not managed in a scientific manner. It has been roughly estimated that of the 4 kg of waste generated in a hospital at least 1 kg would be infected. Bio-medical waste means “any solid and/or liquid waste including its container and any intermediate product, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research pertaining thereto or in the production or testing thereof.” Bio Medical waste consists of human anatomical waste like tissues, organs, body parts, animal wastes generated during research, from veterinary hospitals, microbiology and biotechnology wastes, waste sharps, hypodermic needles, syringes, scalpels, broken glass, discarded medicines and cyto-toxic drugs, soiled waste, such as dressing, bandages, plaster casts, material contaminated with blood, tubes, catheters, liquid waste from any of the infected areas, incineration ash and other chemical wastes. Several health hazards are associated with poor management of bio-medical wastes like injury from sharps to staff and waste handlers associated with the health care establishments. Hospital Acquired Infection (HAI) of patients due to spread of infection. Occupational risk associated with hazardous chemicals, drugs, unauthorized repackaging and sale of disposable items and unused/date expired drugs.*

1. INTRODUCTION

Biomedical waste are the waste disposed in municipal bins, infectious waste generated from diagnosis and treatment of patients, affects other patients, their relatives, friends or visitors and workers in healthcare establishments, if improperly stored or transported inside the establishments. They also affect the general public, the municipal workers and the rag-pickers all of whom come into contact with these wastes, when the wastes are disposed in the open. Quantity of BMW generated in India is 1.5-2kg/bed/day. Only 10-15% is infectious.

1.1. Estimated biomedical waste/bed/day and total equivalent number of beds in Delhi

- Average healthcare waste/bed/day = 1.314kgs

- Average Biomedical waste/bed/day = 0.434kgs
- Equivalent number of beds in human HCEs = 41048
- Equivalent number of beds in veterinary HCEs = 15729
- Equivalent number of beds in research institutions = 1123
- Total Equivalent number of beds in HCEs and research institutions of Delhi = 57900
- Equivalent number of beds covered by own treatment facilities available in HCEs of Delhi = 26742
- Equivalent number of beds that need to be covered through common treatment facilities in human HCEs = 14306
- Equivalent number of beds that need to be covered through common treatment facilities in veterinary HCEs = 15729
- Equivalent number of beds that need to be covered through common treatment facilities research institutions = 1123
- Total equivalent number of beds that need to be covered through common treatment facilities = 31158

2. TYPES OF INFECTIOUS WASTE

- Isolation wastes -generated by patients having communicable diseases.
- Cultures and stocks of infectious agents
- Human blood and blood products
- Pathological wastes
- Contaminated sharps
- Contaminated carcasses, body parts, and bedding emanate from animals.
- Miscellaneous wastes
 - Wastes from surgery and autopsies include soiled dressings, sponges, drapes, lavage tubes, drainage sets and surgical gloves.
 - Contaminated laboratory wastes
 - Dialysis unit wastes
 - Contaminated equipment

2.1. Classification of Biomedical Waste (BMW)

- Non-plastics:
 - Bandages, dressing, used cotton swabs, human tissues / organs
 - Drugs, mercury, radioactive waste

- **Plastics:**
 - Used gloves, IV sets, syringes, Ryles tubes, rubber drains, sheets, catheters
- **Sharps:**
 - Used needles, cutters
- **Cytotoxics**, are anti-neoplastic which inhibit cell growth and multiplication. These drugs in contact with normal cells can damage them and cause severe disability or even death among those affected. These drugs could be present in the waste generated from the treatment of cancer patients or from other work related to testing and control of cancerous cells. Cytotoxics cannot be disposed off in bulk quantities in medical waste incinerators although small quantities can be incinerated or sterilized and landfilled in engineered landfills.

2.2. Classification of BMW

- **Non –Infective Waste:** All items which do not come in contact with blood/ body secretions of patients.
- **Infective Waste:** Are blood/ body secretions of the patients, body parts, placenta waste, sharps
- **Non- Infective but Hazardous Waste :** Radioactive substance, drugs, mercury.

3. BMW SOURCE AND TREATMENT

Table 1. Classification of BMW

Categories of BMW

Category	Waste
1	Human Anatomical
2	Animal
3	Microbiology & Biotechnology
4	Sharps
5	Discarded Medicines & Cytotoxic Drugs
6	Soiled (Contaminated with Blood & Body Fluids)
7	Solid (Disposable Items other than Sharps)
8	Liquid
9	Incineration ash
10	Chemical

3.1. Color Coded Segregation of BMW

- Waste Categories 1, 2, 3, & 6

Type of Container Plastic bags (Non chlorinated) and bins

Waste Items

- Items contaminated with blood and body fluids e.g. Cotton dressings, soiled plaster cast etc.

- Human tissues, organs e.g. amputated limbs etc.
- Waste from animal houses / experimental laboratories

Treatment Options Incineration

- Waste Categories 4, 7

Type of Container Plastic bags and bins

Waste Items

- Solid waste generated from disposable items e.g. catheters, IV sets, BT sets, tubings, blood bags etc.(except sharps)
- Glassware from laboratories

Treatment Autoclaving shredding

- Waste Categories 5, 9 & 10 (solids)

Type of Container Plastic bags and bins

Waste Items

- All non-hazardous – “general” waste from kitchen, offices, cafeteria, computer facility etc.
- Treatment Options Municipal authority → Secure landfills

Needles:

A) needle destroying machine

B) mechanically cutting tip of syringe Seal in puncture proof container

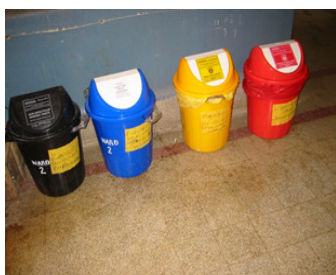
3.2. BMW Treatment at AIIMS

- **INCINERATOR :**
 - Capacity 230 kg/hr; twin chamber; oil fired
 - Charged temperature of primary & secondary chamber being maintained and recorded
 - Air Pollution control device (Ventury scrubber) has been fitted
 - Stack emission being monitored 6 monthly by IIT Delhi
- **AUTOCLAVE:**
 - Capacity 800 Kg/hr
 - Cycles:121 deg C at 18psi for 60 min.
 - Spore validation tests done every week
- **SHREDDER:**
 - Capacity 360 kg/hr
 - Shredded plastics recycled

3.3. Waste Segregation and Treatment

Table 2. Guidelines for Waste

Guidelines for Segregation and Treatment of Waste		
WASTE	CONTAINER COLOR CODE	TREATMENT
A. Non-plastics	Yellow	Incineration
B. Plastics	Blue	Disinfection (chemical treatment/ autoclave / microwave) & Shredding
C. Sharps	Puncture proof translucent container	Disinfection (chemical treatment/ autoclave / microwave) & Shredding
D. Household	Black	Municipal waste



- Segregation and Weighing should take place at source
- Make available colour-coded bins and bags in patient care areas
- Follow a colour-code for different categories of waste
- Personnel should use protective gear while handling waste

Colour coded bins and bags (as per Indian govt. guidelines) are available through the Ministry of Forestry and Environment website. **Bio-Medical Waste (Management and Handling) Rules**, The different colours are:

- **Red or Pink** – contaminated plastics.
- **Yellow** – anatomical and infectious but non-plastic waste. Segregation should take place under supervision.
- **Blue or White** puncture proof container for sharps. Should be placed near point of use.
- **Black** – for toxic and radioactive waste (hazardous non-infectious waste). No breakable items should go into this black bag or bin. Glass materials should go into cardboard boxes.

- All color-coded bins and bags must have bio-hazard sign on them.

Segregation of waste is the “central event” in the management process. It helps reduce the bulk of infectious waste and contains spread of infection to general waste. This practice reduces the total treatment cost, the impact of waste in the community and workers’ risk of becoming infected. Weighing the waste helps to keep stock of the amount of waste being collected in each category, to encourage the facility to minimize waste and to use the treatment facility to optimum. The quanta of waste from high income countries is up to 6 Kg/person/year while in low income countries is approximately 0.5 to 3.0 Kg/person/year. The Indian government may charge from Rs 2.50-5.00 per bed for the treatment of waste from a health care facility. Waste amount varies from state to state. Waste in the black bag may vary, therefore it should be labeled with information on where the waste originated, along with its contents.

Legal Framework

According to Bio-Medical Waste (Management and Handling) Rules, 1998 (amendment 2003) by the Ministry of Forestry and Environment (Bio-Medical Waste Management and Handling Rules). Infectious non-plastic waste needs to be incinerated but since the Government of India has banned incineration, so the best option is to make them noninfectious before disposing them in a landfill. Standards for treatment and disposal of bio-medical waste and for waste autoclaving are available at the website. Liquid waste/effluents: The treatment could consist of: Chemical disinfection using pre-chlorination with a contact time of 15 to 45 minutes and dosing of 6-25 mg/L of chlorine. Followed by neutralization, coagulation and flocculation, skimming and filtration and post chlorination with 1-5 mg/L of chlorine. The resultant effluent can be let into the public sewers.

4. BMW RISK

- Viruses viable upto 7d in blood droplet
- Microbes isolated from 56% samples of “disposable” items
 - *Bacillus micrococcus*
 - *Staph epidermidis*
 - *Serratia sp.*
 - *Ps aeruginosa*
- Injuries from sharps
- Nosocomial infections
- Risk associated with radioactive waste and other toxic drugs
- Pollution of air, water & soil

Operational Aspects

- Holding time -Not more than 48 hours for untreated waste

- Collection -A centralized sanitation gang with supervisor
 - Transportation to central treatment facility- waste routes and vehicles fixed
 - Documentation – At the site of collection and on delivery at treatment site
- All categories of personnel are trained regarding BMW
- Prophylactic immunization to staff against Hepatitis B & Tetanus
- Personal protection gear gloves, caps, masks, gum boots & preferably aprons
- Preparation for Handling Waste
- Personnel Protection
- Process of Waste Handling
- Protection for Waste Handlers
 1. Use personal protective gears
 2. Immunization for
 - → Hepatitis-B (HBV)
 - → Tetanus Toxoid (TT) injection

5. OBJECTIVES OF BMW MANAGEMENT

- **Reduce transmission of HAI**
- **Prevent illegal recycling**

12 Steps to Manage Hazardous Wastes before Disposal

1. Know what hazards you have
2. Purchase smallest quantity needed, and don't purchase hazardous materials if safe alternative exists
3. Limit use and access to trained persons with personal protective gear
4. Use Engineering Controls such as Ventilation, Hoods for Select Hazards
5. Get Rid of Unnecessary Stuff
6. Label with Agent, Concentration and Hazard Warning
7. Communicate about Workplace Hazards
8. Recycle Products When Possible
9. Segregate Hazards at the Source
10. Have Written Policies on Waste Disposal
11. Minimize the Handling of Wastes
12. Conduct Walk-Around Interviews

Waste Handlers to get following vaccines at the time of appointment

- I. Hepatitis B vaccine:
 - Three doses of intramuscular injection
 - Time schedule: 0, 1, 6 months or 0, 1, 2 months
 - II. Tetanus Toxoid vaccine:
 - Two doses of intramuscular injection in the time schedule of 0 and 1 month (if not taken earlier) or
 - One dose of TT if not received with in the last 5 years
- Immunize them, If not done yet

5.1. Safety Precautions for Waste Management

- Training and education of waste handlers and drivers
- Strict protocols on sharps handling and disposal
- Written protocols/colorful posters as reminders for the health care staff
- Limit access to only trained persons with personal protective gear
- Eliminate steps that require unnecessary handling hazardous wastes
- Steps for Bio-Medical Waste Management
- Segregation and weighing
- Transport
- Temporary storage
- Treatment and final disposal

6. PUBLIC HEALTH HAZARDS

The reuse of syringes by the general public represents one of the greatest public health problems in the developing world related to health-care waste. Worldwide, an estimated 10 to 20 million infections of Hepatitis B and C and HIV occur annually from the reuse of discarded syringe needles without prior sterilisation. If health-care waste is dumped on sites or in other areas which can be accessed by the public, and in particular children, they will be in contact with infectious wastes and toxic chemicals, which may cause accidents.

According to the WHO, some of these risks are

Risks caused by poor management of health-care wastes

Poor management of health-care waste causes serious disease in health-care personnel, waste workers, patients and the general public. The main cause of illness from infectious waste is probably **injuries with used needles, which can cause hepatitis and HIV**. There are however numerous other diseases which could be transmitted by contact with health-care wastes

Risks from healthcare waste - Sharps

In any healthcare establishment, nurses and house-keeping personnel are the main groups at risk of injuries; annual injury rates are 10-20 per 1000 workers. Highest rates of occupational injury among all workers who may be exposed to health-care waste are reported by cleaning personnel and waste handlers; the annual rate in USA is 180 per 1000 (WHO, 1999). Risk of infection of Hepatitis B after needle stick injury - ROT to susceptible Health Care Workers (HCWs) is 6 – 30% after single needle stick exposure. The risks of infection to HIV after needle stick injury as documented in the combined data of more than 20 prospective studies world-wide, are average transmission rate 0.3% per injury (WHO, 1999).

Occupational Health Hazards

Health-care personnel and waste workers (within and outside the HC) will be **in contact with waste**, if it hasn't been packaged safely. Many **injuries occur because syringe needles or other sharps** have not been collected in safety boxes, or because these have been overfilled.

On landfills and dumpsites, **waste recyclers or scavengers may be in contact with infectious wastes** and especially those which have been disposed of without prior treatment

7. CONCLUSION

- There is a lack of motivation, awareness and education among different levels of healthcare staffs about the proper handling of HCW.
- Urgent Need to provide knowledge and training to different categories of Healthcare staff about safe biomedical waste management practices and its disposal.
- Although needle cutters and destroyers are available, they are mostly out of order. Hence, syringes along with the needles are often put in the disinfectant solution as such. These keep floating around without getting disinfected.
- Sharp items are often seen mixed with general waste in black liners.
- This shows the need of training for sharps management and effective disinfection procedure.
- Both nurses and housekeeping staff admitted that they get sharp injuries during handling of waste.
- Incidences of injuries and infection due to chemicals, dust & fumes and soiled linen have also been reported.
- During the profile survey, the nodal officer himself admitted the incidences of injuries due to sharps.
- Need to provide information about reporting and investigation procedure on having needle stick injuries.
- Scenario
- Hospital is not having its own treatment facility for biomedical waste.
- The waste is given to common facility provider for treatment and disposal but the common facility provider is not necessarily taking it or transporting the same properly.
- There is an autoclave and shredder for treatment of infectious plastic. The infectious plastics are being autoclaved and then shredded.

- There is an incinerator also for treatment of infectious solid waste such as anatomical waste, pathological waste, soiled cotton.
- Both facilities are used as common treatment facilities.

7.1. Concern

- Whether the medical waste is to be treated within the hospital or in a common facility, there is an urgent need to reduce the quantity of infectious waste generated. If segregation is not proper, almost all hospital waste will have to be treated as infectious waste.
- Therefore, there is also an urgent need to keep the infectious waste stream separate from the non-infectious waste stream by segregating at source so that the amount of waste to be treated is kept to the minimum - this will also bring down the cost of waste disposal.
- Source segregation of different types of waste has to be carried out diligently in OTs, ICUs, wards and general areas.

It is also important to implement the integrated healthcare waste management plan to disinfect/sterilize and treat the source-segregated waste either within the hospital, if it is a large facility, or in a common facility if the healthcare establishment is small.

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