Medical Waste Management
What is Medical Waste?

- The term includes what is commonly described as garbage, refuse and trash. The US EPA’s regulatory definition of waste includes any discarded item; things destined for reuse, recycle, or reclamation; sludge and hazardous waste. It is also called healthcare waste or clinical waste.

- Broadly, medical waste is defined as any solid or liquid waste generated in the diagnosis, treatment or immunization of human beings or animals in research pertaining thereto, or in the production or testing of biological (NAN & HCWH, 1999 Medical Waste in Developing Countries).
Sources of Medical Waste

- Different sections of hospitals and clinics
- Pathological laboratories
- Diagnostic centers
- Doctors’ offices
- Other medical and research facilities
- Food facilities
- Medical stores
Classification of Medical Waste

A. Based on content (solid, liquid, gaseous, radioactive)
B. Based on health impact (general waste and hazardous waste)
C. Based on WHO classification for developing countries (general waste, sharp waste, infectious waste, chemicals and pharmaceutical waste, other hazardous waste).
## Waste Components Generated by Healthcare Activities

These wastes include hazardous (sharps, infectious and non-infectious) and non-hazardous materials (general waste):

<table>
<thead>
<tr>
<th><strong>Sharps</strong> (used needles, syringes, blades, scalpel, razors, broken glass)</th>
<th><strong>Soiled dressings</strong></th>
<th><strong>Pathological materials</strong> (human tissue, organ feces, body parts, biopsy products and autopsy materials)</th>
<th><strong>Diagnostic samples</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blood</strong></td>
<td><strong>Chemicals</strong> (reagents, developers, and those toxic, flammable, explosive and or carcinogenic)</td>
<td><strong>Pharmaceuticals</strong> (expired medication, discarded residual medication used in chemotherapy)</td>
<td><strong>Medical devices</strong></td>
</tr>
<tr>
<td><strong>Radioactive materials</strong> (solid or liquid waste contaminated with radioactive substances)</td>
<td><strong>Normal kitchen and office waste</strong> (similar to municipal solid waste)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Composition of Medical Waste
Nature and Composition of Medical Waste

- General waste, 80%
- Infectious, 15%
- Chemical, 3%
- Sharps, 1%
- Others, 1%

Source: WHO, 2000
## Category of Waste, Examples and Environmental Concerns

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
<th>Environmental concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>General or Municipal Solid waste</td>
<td>Paper, packaging, food, floor sweepings and other items not unique to medical waste, commonly managed by municipal collection and disposal</td>
<td>Volume of the waste; Air emissions; Contamination of surface and ground water; Litter; Insects or other vectors; Odors; Injury; Exposure to Pathogens</td>
</tr>
<tr>
<td>Infectious waste containing pathogens in sufficient quantity that exposure could result in disease</td>
<td>Lab cultures and stocks of infectious agents, wastes from isolation wards, tissues, materials or equipment that have been in contact with infected patients</td>
<td>Land disposal of active pathogens Human health impacts</td>
</tr>
<tr>
<td>Pharmaceutical waste</td>
<td>Expired or unnecessary pharmaceuticals and drugs</td>
<td>Released to land or water Human health impacts</td>
</tr>
<tr>
<td>Pathological waste containing human tissues or</td>
<td>Body parts, human fetuses, blood, and other body fluids.</td>
<td>Untreated waste released to land or water; Human health impacts</td>
</tr>
<tr>
<td>Chemical waste</td>
<td>Solid, liquid and gaseous chemicals from diagnostic and experimental work, cleaning materials</td>
<td>Released of hazardous air pollutants and releases to land or water; Human health impacts</td>
</tr>
<tr>
<td>Sharp wastes</td>
<td>Needles, infusion sets, scalpels, broken glass</td>
<td>Land disposal of active pathogens; Injury</td>
</tr>
<tr>
<td>Radioactive waste</td>
<td>Radioactive substances including used liquids from radiotherapy or lab work</td>
<td>Releases to air, land or water; Human health impacts</td>
</tr>
<tr>
<td>Pressurized containers</td>
<td>Gas cylinders, cartridges and aerosol cans</td>
<td>Potentially harmful; May explode accidentally</td>
</tr>
<tr>
<td>High heavy metal content</td>
<td>Batteries, broken thermometers, blood pressure gauges</td>
<td>Releases to air, land or water; Human health impacts</td>
</tr>
<tr>
<td>Genotoxic waste</td>
<td>Waste containing cytotoxic drugs (used in cancer therapy), genotoxic chemicals</td>
<td>Releases to air, land or water; Human health impacts</td>
</tr>
</tbody>
</table>

Source: Medical waste training manual, DGHS, Mohakhali, Dhaka
The Disease Transmission Cycle

**Susceptible Hosts**
- Clients
- Community
- Service providers
- Ancillary staff
- Com. members

**Places of entry**
- Broken skin
- Puncture wound
- Surgical site
- Mucous membranes

**Infectious Agent**
- Bacteria
- Viruses
- Fungi
- Parasites

**Reservoir**
- People
- Water bodies
- Instruments
- Equipment

**Places of Exit**
- Skin, Respiratory, system
- Genitourinary
- & vascular systems

**Mode of Transmission**
- Contact
- Vehicle
- Air
- Vector

*Source: Medical waste training manual, DGHS, Mohakhali, Dhaka*
Potential Risks and Hazards Associated with Medical Waste

1. Injuries and accidents (Nurses and housekeeping personnel are the main groups at risk associated with cut-injury, punctured wound, laceration, strain and sprain of the joint of limbs and backache).

2. Infectious medical waste and the Associated Risks

<table>
<thead>
<tr>
<th>Pathogenic Organisms in Infections Waste</th>
<th>Associated Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial</td>
<td>Tetanus, gas gangrene and other wound infection, anthrax, cholera, other diarrhoeal diseases, enteric fever, shigellosis, plague etc.</td>
</tr>
<tr>
<td>Viral</td>
<td>Various hepatitis, poliomyelitis, HIV-infections, HBV, TB, STD rabies etc.</td>
</tr>
<tr>
<td>Parasitic</td>
<td>Amoebiasis, giardiasis, ascariasis, ankylomastomiasis, taeniasis, echinococcosis, malaria, leishmaniasis, filariasis etc.</td>
</tr>
<tr>
<td>Fungal infections</td>
<td>Various fungal infections like candidiasis, cryptococcoses, coccidiodomycosis etc.</td>
</tr>
</tbody>
</table>


3. Hazardous medical waste risk (due to types of chemicals used in medical facilities and pharmaceutical industries)

4. Groups at most risk (Waste pickers, Waste recyclers, Drug addicts (who scaveng for used needles and disposed medicines) and hospital sweepers and other low-grade hospital staff).
Medical waste management is the practice of minimizing, identifying, separating, collecting, handling, carrying, storing and treating and finally disposing of medical waste as per policy of the institution or government.
In-House Medical Waste Management

Careful management is required to:

- Minimize occupational health hazards and
- Develop environmentally friendly medical facility.
Elements of In-House Waste Management

Waste Management Cycle (WHO)

- Supervision & Monitoring
- Waste Minimization
- Training
- Waste Identification
- Record Keeping
- Waste Segregation
- Waste Treatment & Disposal
- Waste Handling
a. Important Elements for effective in-house waste management

1. Waste Minimization

- Source reduction
- Stock management
- Encourage use of Recyclable products
- Control at institution level
- Centralized purchase and monitoring the receipt and supply procedure of medical goods.
2. Waste Segregation:

- Waste separation/isolation is a key to effective waste management.
- The waste is segregated on the basis of composition/type of waste.
- Segregation of waste should occur at the point just after its generation.
- Effective segregation ensures that only small quantities rather than large ones are needed for disposal.
- Incorrect segregation leads to contamination of a large volume of non-hazardous waste turning the whole pack into hazardous waste.
c. Important Elements for effective in-house waste management

3. Waste Identification:

A good way of identifying the waste is by sorting the different components of waste into different COLOR CODE to facilitate easy and safe handling, transportation and waste treatment.

**Recommended Color Code for Developing Countries (WHO)**

<table>
<thead>
<tr>
<th>Type of waste</th>
<th>Color code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly infectious</td>
<td>Red</td>
</tr>
<tr>
<td>Infectious, Pathological, Anatomical</td>
<td>Yellow</td>
</tr>
<tr>
<td>Sharp</td>
<td>Yellow colored box</td>
</tr>
<tr>
<td>Chemicals, Pharmaceuticals</td>
<td>Brown</td>
</tr>
<tr>
<td>Radioactive</td>
<td>Silver</td>
</tr>
<tr>
<td>General waste</td>
<td>Black</td>
</tr>
</tbody>
</table>
d. Important Elements for effective in-house waste management

4. Waste Segregation:

- **Waste collection** *(regular and programmed)*
- **Waste collection materials** *(gloves, apron, boots, trolley)*
- **Placement of color bins** *(where the waste is generated)*
- **Labeling** *(containers must be labeled with some basic information)*
- **Security** *(required to prevent scavenging at the generation and disposal sites)*
- **Health and safety of the cleaner in waste management**
- **Personal hygiene** *(continuous water supply and soap/detergent for hand-washing)*
- **Response to injury and exposure** *(need for procedures to deal with accidents)*
- **Emergency response** *(trained personnel and necessary equipment)*
e. Important Elements for effective in-house waste management

5. In-house transportation

- Moving from site of collection to temporary storage area in-house
- There must be equipment for transporting waste containers
- The equipment must be easy to clean, load and unload, leak proof
  Should not be used for any work other than waste transportation
f. Important Elements for effective in-house waste management

6. Temporary in-house storage

- The store should be a room, area or building within the healthcare facility depending on the quantity of waste generated
- Waste must not be stored for more than 24 hours
- Should not be accessible to unauthorized persons and animals
- Must be located away from food preparation, processing and food store
- Should provide easy access to collectors and collection vehicles
- Storage room must be properly ventilated

7. Record keeping

- Accurate record keeping is required for effective medical waste management
- Various records related to risks, failures and problems, cost, quality and quantity of waste etc., must be taken
Transportation for Out-House Management

Collection of stored waste (except radioactive waste) from healthcare facilities according to color code to the final disposal site is done in a covered truck.

Collection of waste as per color-coded from different institutions should be in a covered van and the driver area should be totally separated from the waste carrying area.
Out-House Management and Final Disposal of Medical Waste

Outside hospital (Total system)

Management

Collection

Transport

Infect. Waste

Gen. Waste

Same car different time

Disposal site

Protected Landfill

Treatment

Central incineration

Private firms/NGOs

Big Hosp. Public/private

Municipality

Institutional Cooperation

Optimum & proper resource utilization

Public Participation

Public-Private Partnership
## Technologies for Treatment and Final Disposal

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Incineration</td>
<td>(High temperature dry oxidation process to reduce organic and combustible waste to inorganic matter)</td>
</tr>
<tr>
<td>Chemical disinfection</td>
<td>(Chemicals added to waste to kill/inactivate the pathogens)</td>
</tr>
<tr>
<td>Rendering inert</td>
<td>(Mixing waste with cement in order to prevent leaching/migration of toxic substances)</td>
</tr>
<tr>
<td>Wet thermal treatment</td>
<td>- including autoclaving (Exposure of shredded waste to high temperature and pressure to inactivate micro-organisms before discharge into municipal waste)</td>
</tr>
<tr>
<td>Microwave irradiation</td>
<td>(The heat generated destroys microorganisms)</td>
</tr>
<tr>
<td>Landfill (Sanitary)</td>
<td>(Isolates waste from the environment)</td>
</tr>
<tr>
<td>Encapsulation</td>
<td>(pre-treatment involving filling containers with waste, adding an immobilizing material and sealing the container)</td>
</tr>
</tbody>
</table>
External Waste Management and Final disposal of MWM

- Inadequate Disposal Site
- Inadequate Treatment
- Inadequate Collection system
- Unauthorized Waste Picking

Solid Waste Management

Improper MWMS

- Non-existence of Regulations
- Lack of Awareness
- Absence of Responsibility
- Resource Constraint

Step by Step Implement

- Outside Hospital (Total system)
- In-house Management

- Training
- Good housekeeping
- Capacity building

Public and Political Awareness

- Civic sense
- Health & environment

Disposal
- Treatment
- Transport
- Collection
Requirements for Effective Waste Management

- National Policy, Strategy, plan, guidelines and SOPs
- Legislation/Rules for waste management
- Good management
- Committed manpower
- Good management
- Proper budgetary allocation
- Application of local available technology and also according to resource allocation
- Involvement of NGOs
- Community participation
- Proper capacity development of the service providers
- Development of information system in relation to MWM as a part of MIS
- Supportive supervision and monitoring