Management of Hazardous Healthcare Wastes

7 August 2019
Syndicate of Hospitals

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Presentation Outline

- Types of Healthcare Wastes
- Adverse health effects of the mismanagement of hazardous healthcare waste
- Management of hazardous healthcare waste
  - Minimization,
  - Segregation,
  - Handling, storage and transport,
  - Treatment and final disposal
- Hazardous healthcare waste management in Lebanon
- Challenges and opportunities

Types of Healthcare Waste - (Decree 13389/2004)

1 Non- Hazardous Waste

- Paper
- Food
- Packaging
- Plastics
- Glass

2 Hazardous Infectious Waste

- Sharps (needles)
- Waste contaminated with blood and body fluids

3 Hazardous Non-Infectious Waste

- Used X-ray fixer and developer solution
- Amalgam (containing silver and mercury)
- Used Solvents
- Formaldehyde
- Chemical solutions
- Disinfectants, cleaners and other chemicals

Types of Healthcare Waste – (Decree 13389/2004)

4 **Waste that need special treatment**

- Expired Pharmaceuticals
- Pathological waste
- Cytotoxic waste

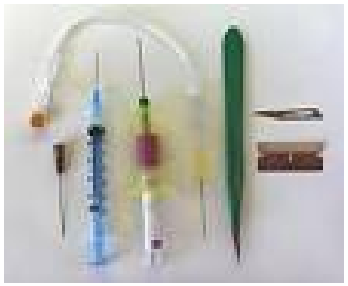
5 **Radioactive Waste**

- Sharps (needles)
- Waste contaminated with radioactive substances

Hazardous Infectious Waste

Waste that is suspected to contain pathogens (bacteria, viruses, parasites, or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts.

- **Sharps Waste**
  - Items that could cause cuts or puncture wounds **whether or not they are infected**
    - Needles, hypodermic needles
    - Scalpel and other blades
    - Knives
    - Infusion sets
    - Saws, broken glass, pipettes



Hazardous Non-Infectious Waste

Chemical Waste

Discarded solid, liquid and gaseous chemicals from diagnostic, therapeutic and experimental work and from cleaning and disinfection.

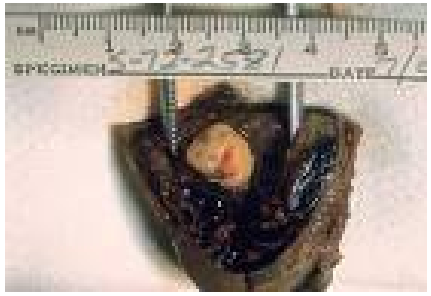
- Hazardous chemical waste have at least one of the following properties:
  - Toxic
  - Corrosive
  - Flammable
  - Reactive (explosive, water-reactive, shock-sensitive)
  - Oxidizing

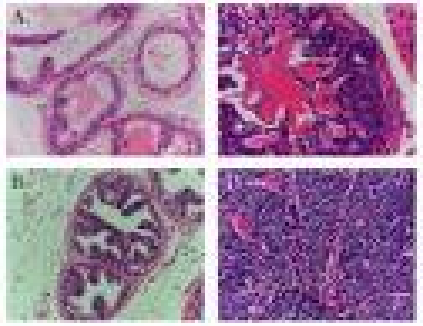
Examples

- Formaldehyde, glutaraldehyde
- Photographic fixing and developing solutions
- Laboratory solvents
- Mercury in thermometers and sphygmomanometers
- Disinfectants
- Cleaners, degreasers

Waste that need Special Treatment

- **Pathological Waste**
  - Waste that consists of tissues, organs, body parts, blood, body fluids, and other waste from surgery and autopsies of patients with infectious diseases
  - Includes infected animal carcasses
  - May include healthy human body parts (except teeth), animal body parts and fetuses





Waste that need Special Treatment

- **Pharmaceutical Waste**
  - Waste that consists of expired, unused, split, and contaminated pharmaceutical products, drugs, vaccines, and sera no longer used.
  - Includes discarded items used in the handling of pharmaceuticals, such as bottle or boxes with residues, gloves, masks, connecting tubing, and drug vials.
  - Includes cytotoxic (chemotherapeutic or antineoplastic) waste.

Mixed Wastes

Hazardous Waste

- **Chemical**

- **Drug**

- **Radioactive**

- **Biohazardous**

Priority:

1. Radioactive Waste
2. Chemical & Drug Waste
3. Biohazardous Waste
4. Regular Waste

Adverse Health Effects of Infectious Waste

- The most common diseases transmitted through accidental exposure to infectious waste include:
  - **AIDS;**
  - Gastroenteric infections;
  - Respiratory infections;
  - Ocular infection;
  - Genital infections;
  - Skin infections;
  - **Anthrax;**

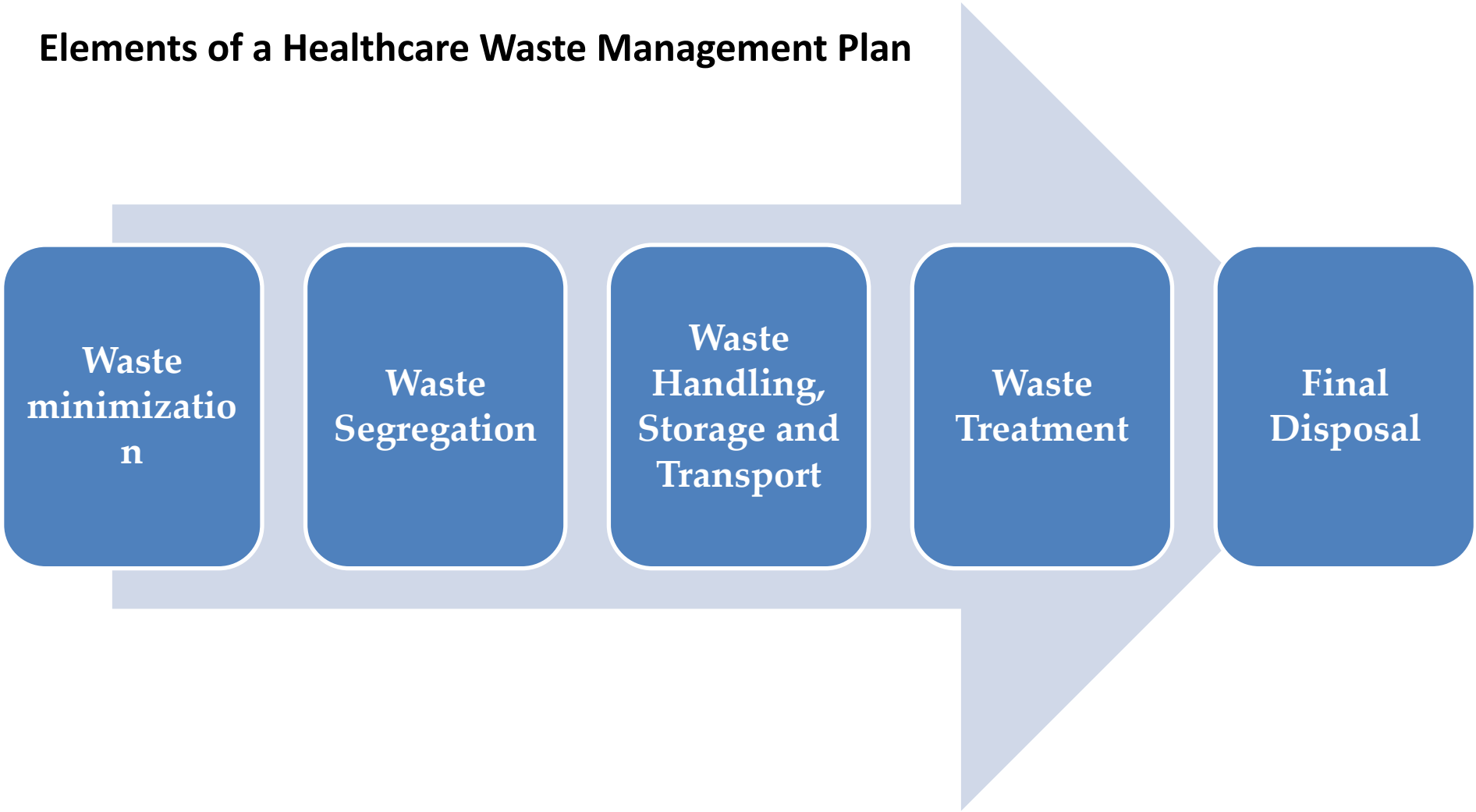
- Meningitis;
- Haemorrhagic fevers;
- Septicemia;
- Bacteremia;
- Candidemia;
- **Viral hepatitis A, B and C**

Adverse Health Effects of other Special Waste

Type of Waste	Routes of Exposure	Adverse Health Impacts
Chemical & pharmaceutical waste	• Absorption through the skin or the mucous membranes; • Inhalation; • Ingestion; • Injection.	**Intoxication; Burns; Injuries** to the skin, the eyes, or the mucous membranes of the airways.
Cytotoxic waste	• Absorption through the skin or the mucous membranes; • Inhalation; • Ingestion; • Injection.	**Carcinogenicity; Mutagenicity**; Dizziness; Nausea; Headache; Dermatitis; Spontaneous abortion; Stillbirths.

Management of Hazardous Healthcare Waste

Elements of a Healthcare Waste Management Plan



Waste Minimization

Infectious Waste

- Proper segregation of waste
- Using non-disposable items for medical procedures where their reuse after cleaning can be demonstrated to minimize infection transmission to acceptably low probabilities
- Recycling materials provided they are disinfected to eliminate possible pathogens, and safe handling guidelines are followed.

Chemical Waste

- Elimination of hazardous substances.
- Substitution of hazardous substances with less hazardous ones.
- Reusing chemical waste when possible.
- Recycling chemical waste.
- Using of physical rather than chemical cleaning methods (e.g. steam disinfection instead of chemical disinfection).

Pharmaceutical Waste

- Optimizing drug container sizes in purchasing.
- Returning outdated drugs to manufacturer.
- Centralizing chemotherapy compounding location.
- Minimizing waste from compounding hood cleaning.
- Providing spill cleanup kits
- Properly segregating wastes

Healthcare Waste Segregation

Example	Waste category	Color coding & labeling
- Paper - Plastic - Metals - Organic matter	Non Hazardous	
- Blades - Needles - Syringes	Sharps	
- Items contaminated with blood or other body fluids	Hazardous Infectious Waste	
- Chemicals - Expired Drugs	Hazardous Non Infectious & Special Waste	

Healthcare Waste Segregation

Example	Waste category	Color coding & labeling
Items soiled with cytotoxic drugs	Cytotoxic Waste	
Blades, Needles, Syringes soiled With cytotoxic drugs	Cytotoxic Sharps	
Anatomical & body parts	Pathological Waste	
Items soiled with radioactive material	Radioactive Waste	

Handling and Storage of Healthcare Waste

- Waste collection has to be carried out from “clean to dirty”.
- A fixed route has to be planned until the interim storage location.
- The frequency of collection has to be carefully planned to ensure there are no overflowing waste containers.
- **The routing plan will depend on:**
  - Waste volume and number of bags.
  - Waste type.
  - Capacity of the storage area.
  - Capacity of the transporting vehicle.
  - Transport distances and times between collection points.

Healthcare Waste Storage

Storage rooms requirements:

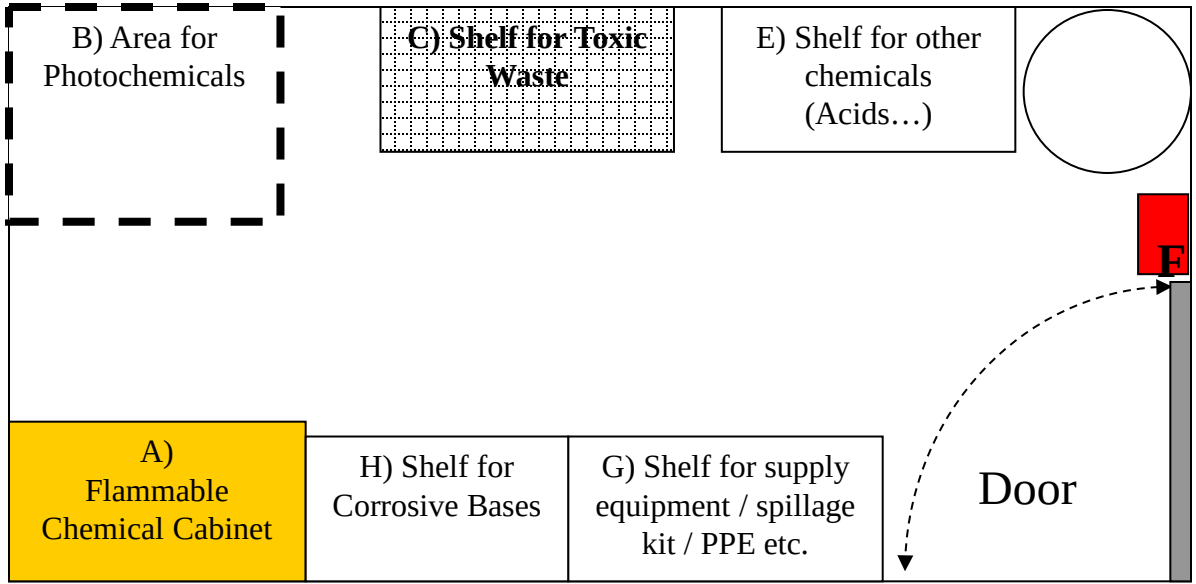
- ✓ Storage capacity consistent with waste generation rates
- ✓ Impermeable, hard-standing floor with good drainage;
- ✓ Easy to clean and disinfect.
- ✓ There should be a water supply for cleaning purposes.
- ✓ Easy access for staff in charge of handling the waste
- ✓ Possibility to lock the store to prevent access by unauthorized persons
- ✓ Good lighting and ventilation
- ✓ Inaccessible for animals, insects, and birds
- ✓ Available spill management equipment

Warning signs

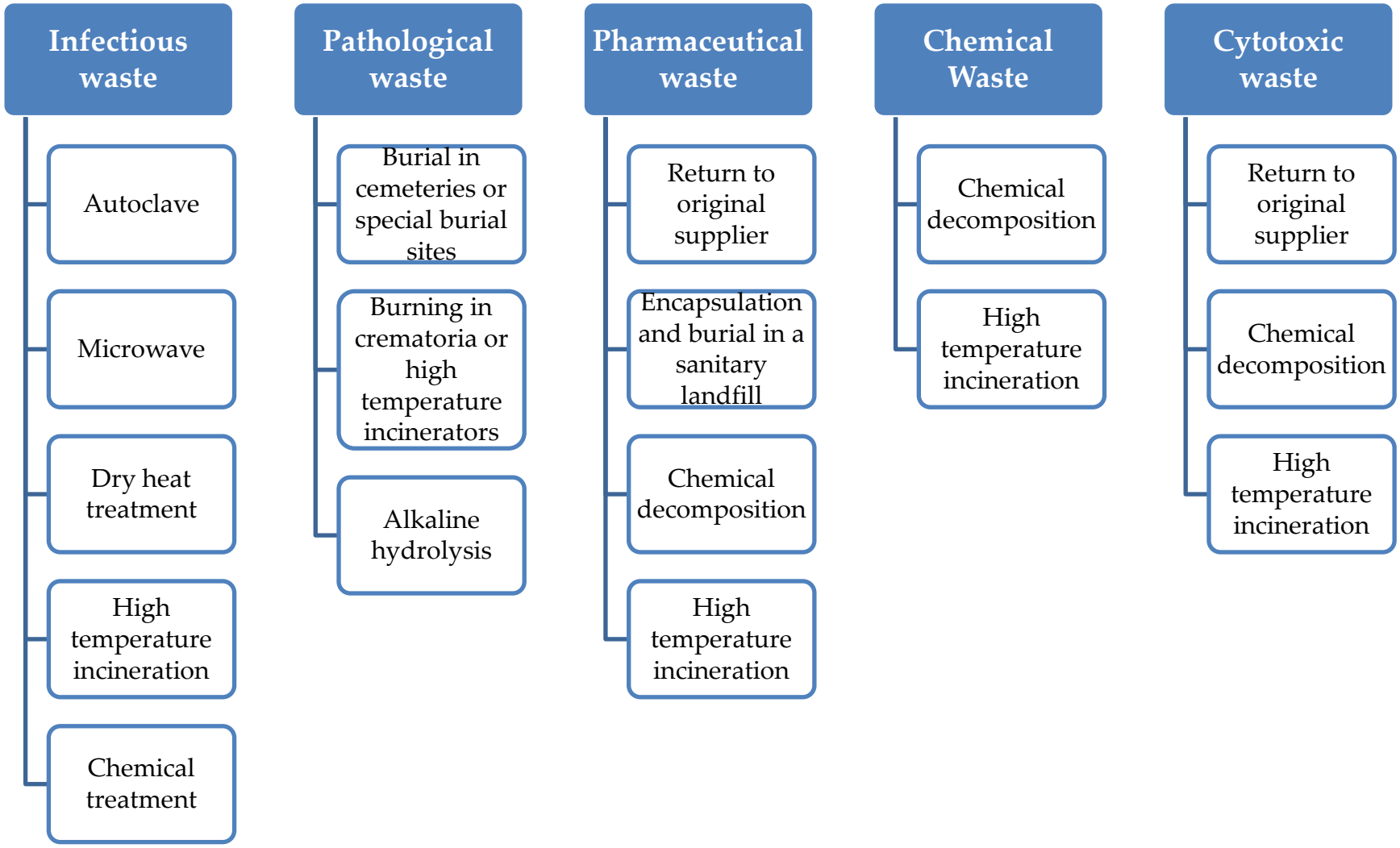
- Storage period of infectious waste should not exceed 24 hours as per Decree 13389/2004.
- In the event of having to store infectious waste for longer periods, it should be stored in refrigerated storage rooms in temperatures ranging between 3ºC and 8ºC.

Storage of Hazardous Chemical Waste

- Should be stored in a separate area, room, or building and be enclosed.
- Should have good ventilation.
- Should contain safety shower and eyewash station, fire detection and suppression systems.
- Should be equipped with a liquid or chemical proof sump (secondary containment).
- Should be specialized for this type of waste – Proper labelling
- Liquid and solid waste shall be stored separately.



Healthcare Waste Treatment Options



Criteria for Selection of Treatment Method

- Waste characteristics, types and quantities
- Technology capabilities and requirements
- Volume and mass reduction
- Regulatory requirements
- Available space for equipment
- Location and surroundings of the treatment site and disposal facility
- Public acceptability
- Infrastructure requirements
- Operation and maintenance requirements
- Skills needed for operating the technology
- Environmental and occupational health and safety considerations
- Cost considerations (capital, O&M, testing, environmental monitoring and decommissioning)

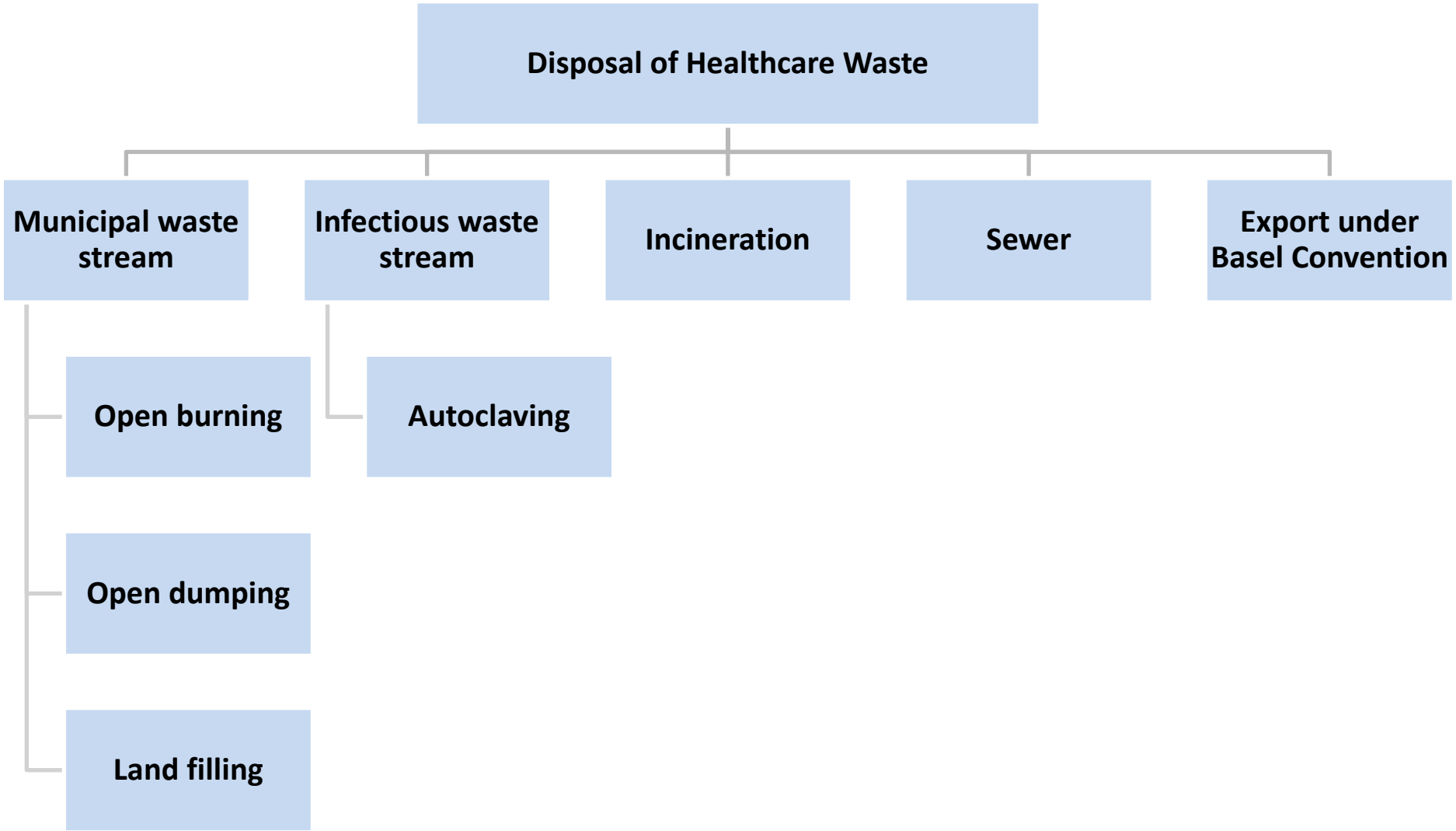
Healthcare Waste Management in Lebanon

Facts and Figures

	Numbers	Beds
Private Hospitals (short stay)	127	11,523
Private Hospitals (long stay)	22	3,677
Public Hospitals	28	2,550
Army Hospitals	3	114
Laboratories	78	
Dispensaries	33	

- The quantity of infectious healthcare waste generated in Lebanon is estimated at **7,500 t/yr**
- The quantity of infectious healthcare waste generated per bed per day is estimated at **1.5 to 1.75 kg**.
- 70 % of the infectious healthcare waste are treated at arcenciel facilities through autoclaving and shredding and final disposal in sanitary landfill (around 5,000 t/yr)
- Few hospitals treat their infectious waste on their own premises
- Cytotoxic and chemical waste generation is estimated at **65-90 t/yr** (based on a recent questionnaire sent to hospitals)
- Lack of national infrastructure to treat and dispose of special healthcare waste.
- Expired pharmaceuticals are being exported for disposal in Europe.

Practices for Treatment & Disposal of Healthcare Waste in Lebanon



Treatment of Infectious Healthcare Waste

- Autoclaving is the method currently adopted for the sterilization and treatment of infectious healthcare waste.
- Sterilized waste is disposed of in sanitary landfills
- Treatment cost of infectious healthcare waste = 0.5 - 1.0 USD/Kg.
- 6 central treatment facilities for infectious waste are available in the different Lebanese Regions.
- Several hospitals treat their infectious waste internally.

Chemical Waste Treatment and Disposal

- Due to the lack of national infrastructure for the disposal of chemical/pharmaceutical waste, the only available option would be to export them under Basel Convention for proper treatment and disposal.
- The syndicate of Hospitals signed in 2019 two MOUs with 2 companies (Solutions and Treveria) to facilitate export of chemical waste (including pharmaceuticals and part of cytotoxic wastes) generated by healthcare centers for disposal in Europe
- Some hospitals are exporting their chemical waste for treatment in Europe

Process Challenges

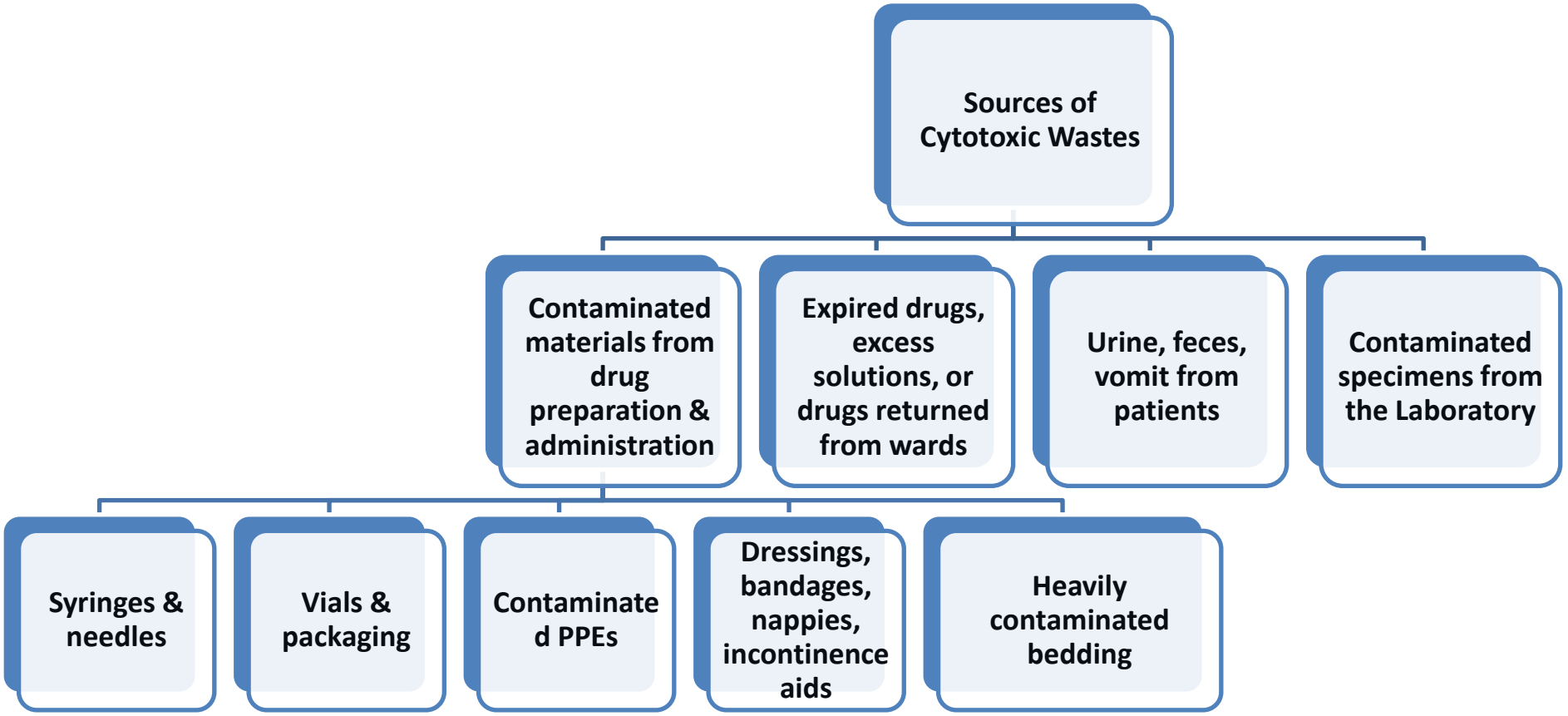
- Very costly process
- Cytotoxic or chemical waste contaminated with biohazardous infectious waste cannot be shipped abroad
- Some chemicals such as mercury are not accepted in all destination countries
- Lengthy process: between 4-8 months to secure initial permits and approvals
- Transit countries may reject accepting the shipment to pass through
- Not all exporters can secure the Environmental Insurance

Example of Chemical Waste Export

Chemical Waste Export From AUBMC

- Since 1997 to date, AUBMC has successfully exported **7 shipments of mixed hazardous chemical wastes (including pharmaceuticals and cytotoxic drugs)** amounting to around **67 tons** under the Basel convention with the coordination of the Lebanese Ministry of Environment.
- Currently, AUBMC is exporting around **12.0 tons of hazardous chemical waste to United Kingdom** through a contract with a UK company – Pegasus Waste Management.

Cytotoxic Waste Management



- In specialized oncological hospitals, cytotoxic waste may constitute as much as **1 to 2 % of the total healthcare wastes**.
- Some hospitals incinerate their cytotoxic waste in onsite waste incinerators
- Others are storing them pending their export for proper disposal
- Others dispose of cytotoxic waste by mixing them with other wastes

Cytotoxic Waste Treatment

Cytotoxic waste is highly hazardous and **should never be autoclaved, landfilled or discharged into the sewerage system**

High temperature incineration in double combustion chamber incinerators to temperature exceeding 1,000 degrees C and state of the art flue gas treatment is the only solution to treat cytotoxic waste

Where neither high-temperature incineration nor exportation of cytotoxic wastes for adequate treatment to a country with the necessary facilities and expertise is not possible, **encapsulation or inertization may be considered as a last resort.**

Radioactive Waste Management

Radioactive waste generated in healthcare centers is classified according to:

Level of Activity

- High Level
- Medium Level
- **Low Level**

Half-Life

- **Short half life** (less than a month)
- **Long half life** (more than one month)

Form

- **Solid Waste** (gloves, syringes, generators, sealed sources, animal carcasses…)
- **Liquid Waste** (patients excreta, scintillation solutions …)
- **Gaseous Waste** (Exhausted gas in Nuclear Medicine)

- **In Hospitals**, most of the waste is of **Low Level Activity** and occasionally Medium Level.
- Particular attention shall be made to ensure proper collection, segregation and storage of radioactive waste.

Examples of Radioactive Waste

Radioactive Waste Management

Radioactive waste in healthcare centers is managed in one or a combination of the methods below:

- **Delay and Decay:** Solid and liquid radioactive waste of short half-lives (Exp: Tc-99m and I-131 waste).
- **Dilution and dispersion:** applicable only when the concentrations in the solid, liquid, or gaseous waste is within the regulatory limits.
- **Incineration:** insoluble liquids and combustible solids – must be operated under controlled conditions
- **Return to the supplier:** used generators, iridium sources ….
- **Long-term On-Site storage** (till transport to final disposal facility): Calibration sealed sources, orphan sources, brachytherapy, blood irradiation …

Challenges & Opportunities

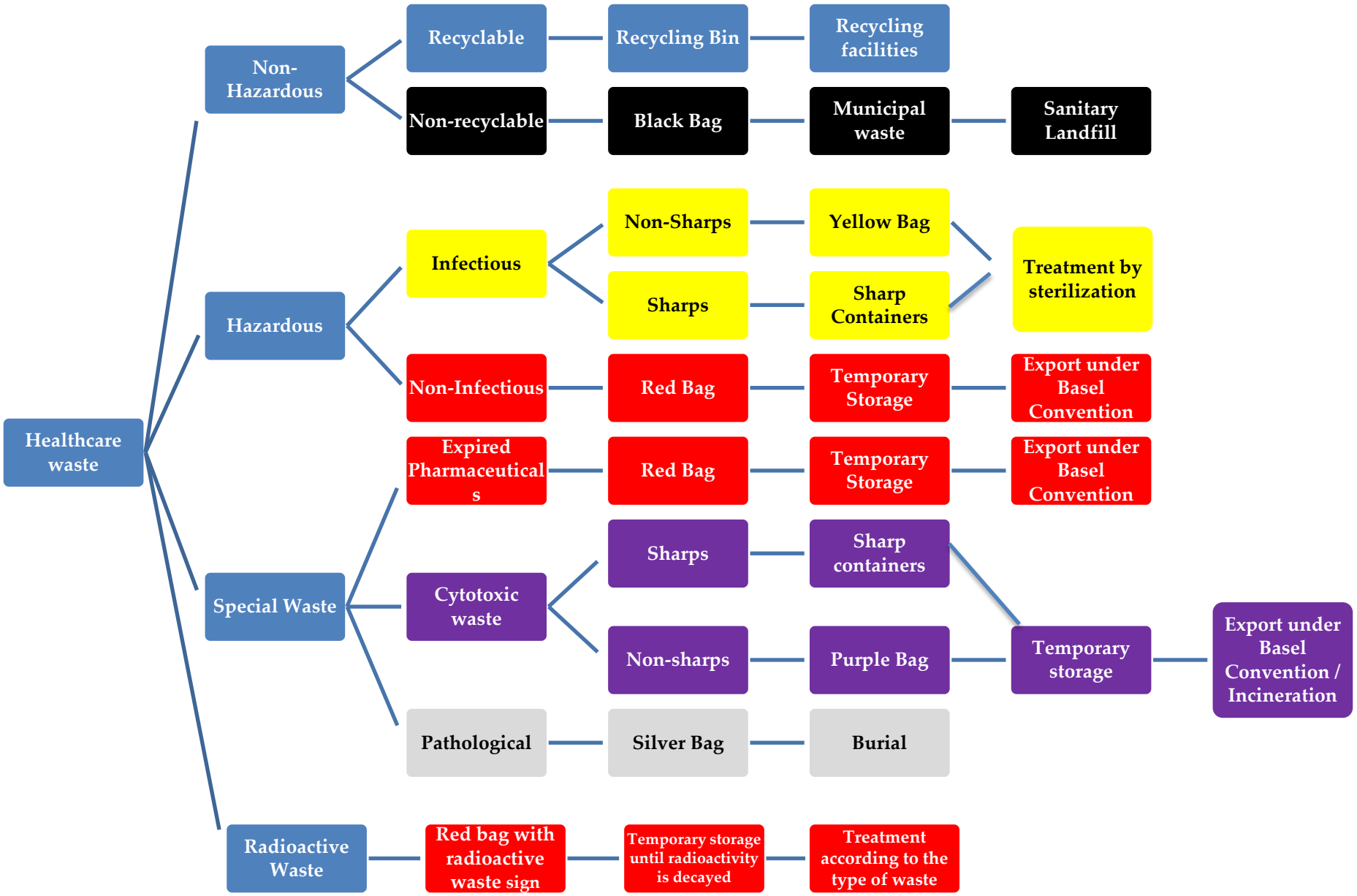
Challenges

- Lack of national strategies and plans for the management of hazardous healthcare waste.
- Lack of infrastructure & treatment technologies for treatment & disposal of hazardous HCW.
- Lack of national expertise in hazardous waste management.
- Export of chemical and pharmaceutical waste under Basel Convention necessitates extensive paper work and is very costly.
- Mixed cytotoxic waste is hard to treat locally and to export abroad.
- Low level of legal enforcement (though improving).
- Lack of national capacity for the testing and laboratory analysis of certain pollutants.

Opportunities

- Some initiatives are taking place to export chemicals, expired pharmaceuticals and cytotoxic drugs under Basel Convention.
- MOU between syndicate of hospitals and two companies for the export of waste is in place.
- Hospitals can join forces to cooperate and export hazardous waste under Basel Convention creating economies of scale.
- Private sector initiatives to establish hazardous waste treatment facilities should be initiated.
- Draft decree for the management of hazardous waste is being prepared at MoE and should be enacted.

Summary of Healthcare Waste Management



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THANK YOU

Questions?