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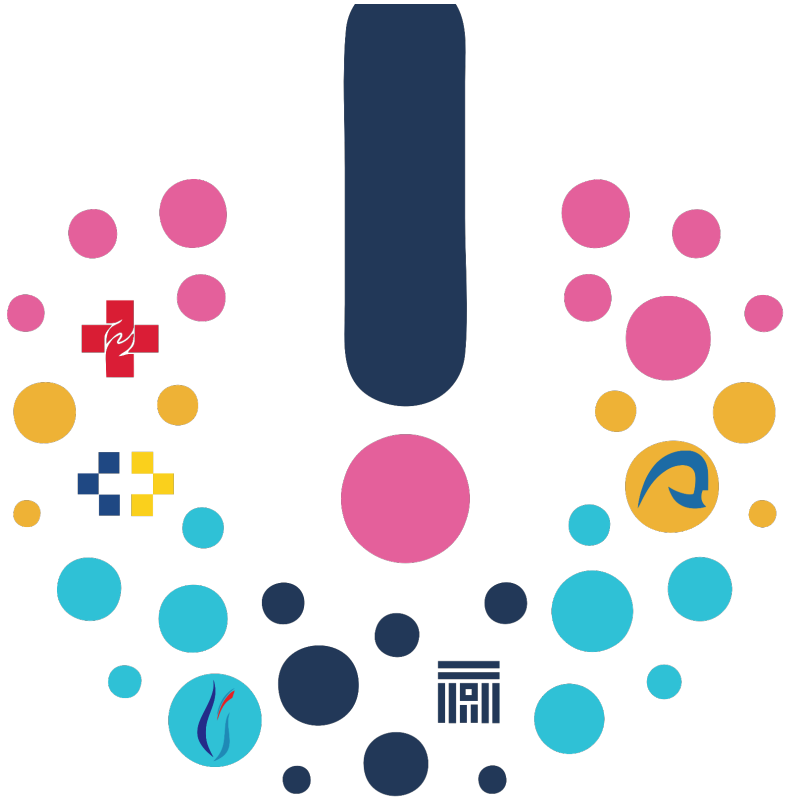


SHEng

SMART HEALTHCARE ENGINEERING

# Hazardous waste disposal

Liana Sanda Baltes

Universitatea Transilvania din Brașov

# CONTENT

- Medical waste collection
- Steps regarding waste collection
- Examples of medical waste color code
- Stages of medical waste
- Impact on the environment and health

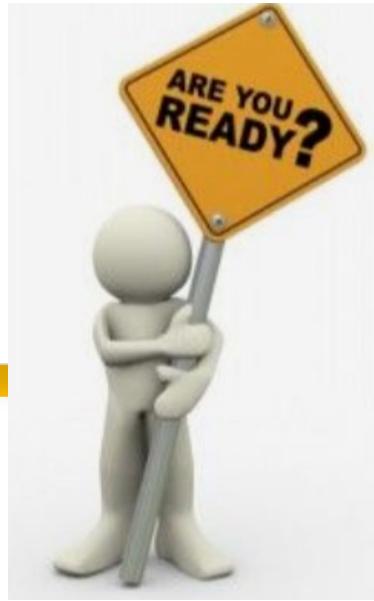
# What this presentation is about?

- If you will find a used syringe in a park, do you consider it to be ordinary waste or a health threat?
- What do a syringe, a blood-stained dressing and an expired drug have in common?
- What risks would arise if medical waste were thrown away/collected with household garbage?
- Do you think medical waste is a problem for hospitals or for society as a whole?
- How much medical waste do you think a hospital produces in a day?

# What this presentation is about?

- ❑ Medical waste is not just a by-product of medical treatment!
- ❑ It represents a major challenge for public health and environmental protection!
- ❑ Today we will see why a correct management is so important!

**MEDICAL WASTE AFFECTS US DIRECTLY, EVEN IF WE DO NOT WORK IN THE MEDICAL FIELD!**

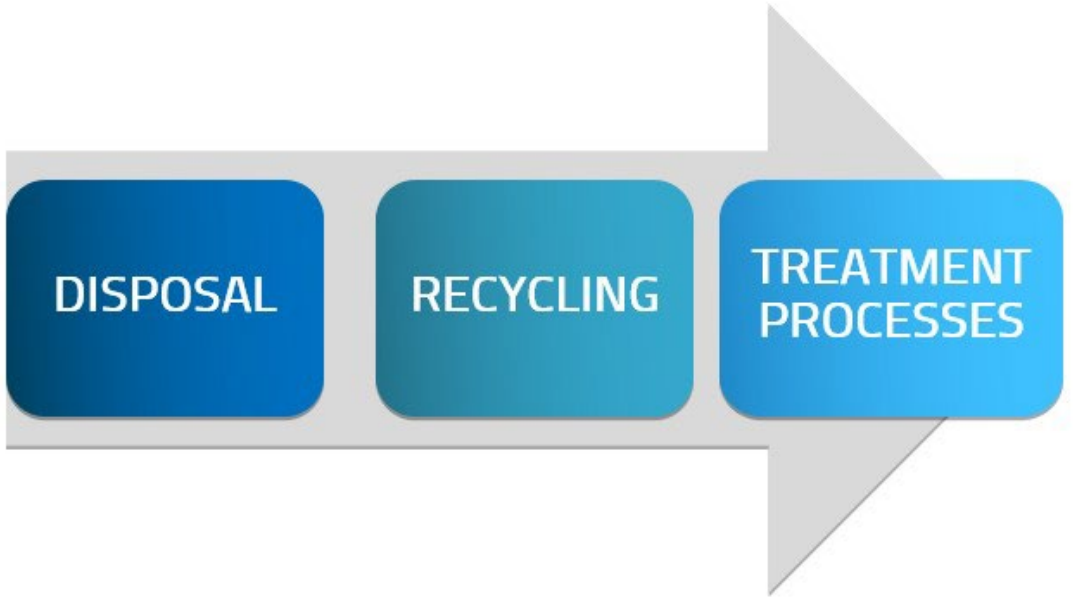


- To **avoid the accumulation of waste** and **the increase in the number of associated infections**, the frequency of **medical waste** (MW) **collection** should be **as high as once per day.**

- Is important that **general waste not to be collected** at the same time or in the same carriage as **hazardous medical wastes**.
- **Treatment facilities can be located**:
  - **within** the health care facility or
  - **off-site**, in a special separate location, away from patients and public access

  **depending on the entity possibilities**.

- The waste is collected from the health care entity and transported to the treatment facility for one of the 3 situations:



- Many countries have **their national legislation** concerning the waste and **a colour coding system**, that make easier to put **the waste in the proper container**.
- **Labelling the waste containers** is useful to identify the source.
- There are unanimously accepted few steps that must be strictly followed regarding waste collection before it is handed over for the next stages:

## 1. Choosing the right container

| | | |
|---|---|---|
| It is necessary to know exactly **which storage container is for a particular medical waste**, to ensure that the waste ends up in the correct category. | The **containers are built to be puncture-resistant and leak-proof** to avoid leaks during transport and handling. | For example, if a cardboard box is used, it must be assembled so that **the joints are sealed with adhesive tape wide enough to ensure the parts are joined together**. |

# 2. Lining the container with a biohazardous waste sealer bag

| | |
|---|---|
| To protect personnel and the environment, it is recommended that **a dedicated hazardous/biological waste bag**, which is generally red or orange in colour, **be placed in the box/container first.** | These bags are **thick and leak-proof**. |

# 3. Medical waste is separated into categories and then placed in their special containers

For any separation and collection of medical waste you must consider the **legislation** of the respective country. But what is unanimously accepted is that you **never throw recyclable waste together with regular garbage and, for example, with sharp objects.**

Last listed (**needles, syringes, scalpels, etc.**) **are not thrown directly into the bag, but into puncture-resistant and sealable containers.**

These can then be placed in **a larger bin for biologically hazardous waste**.

**Overfilling** a container in volume and weight can lead to injuries and leaks during handling.

# 4. Closing and sealing the red or orange bag

For this step you need **to wear protective equipment** (gloves, mask, etc.).

It is necessary to **remove the air from the top of the bag, so twist and tie with a strong knot to avoid leaks.**

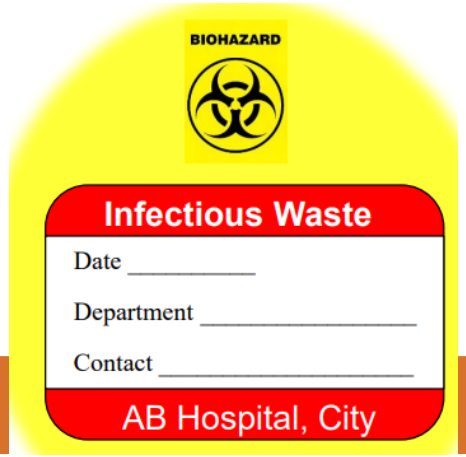
Then the container/box containing the bag is sealed, taking care **not to get any parts of the bag caught between the adhesive tape and the box or between the lid and the box.**

A correct closure protects any worker who will handle the waste later.

# 5. Labelling the container and preparing it for collection

Depending on national regulations and the type of medical waste, it is **labelled differently.**

Generally, most containers are pre-labelled, but if not, it must be **labelled with useful information, namely the name, address of the hospital unit, collection start date, waste category, etc.**




**The area** where medical waste is stored and from where it is to be collected **must be secured and not accessible to the public**

- **The containers** in which medical waste is disposed of, **have different colours**.
- For example, the colours **in Romania**:

**Non-hazardous waste**

**(grey or white)**

**Infectious waste**

**(red or orange)**

**Hazardous chemical waste**

**(yellow)**

**Radioactive waste**

**(blue)**

**Pharmaceutical waste**

**(green)**

- **In UK hospitals**, within the health care facility, the colour code is as below:

anatomical

clinical/ infectious

clinical/ highly infectious

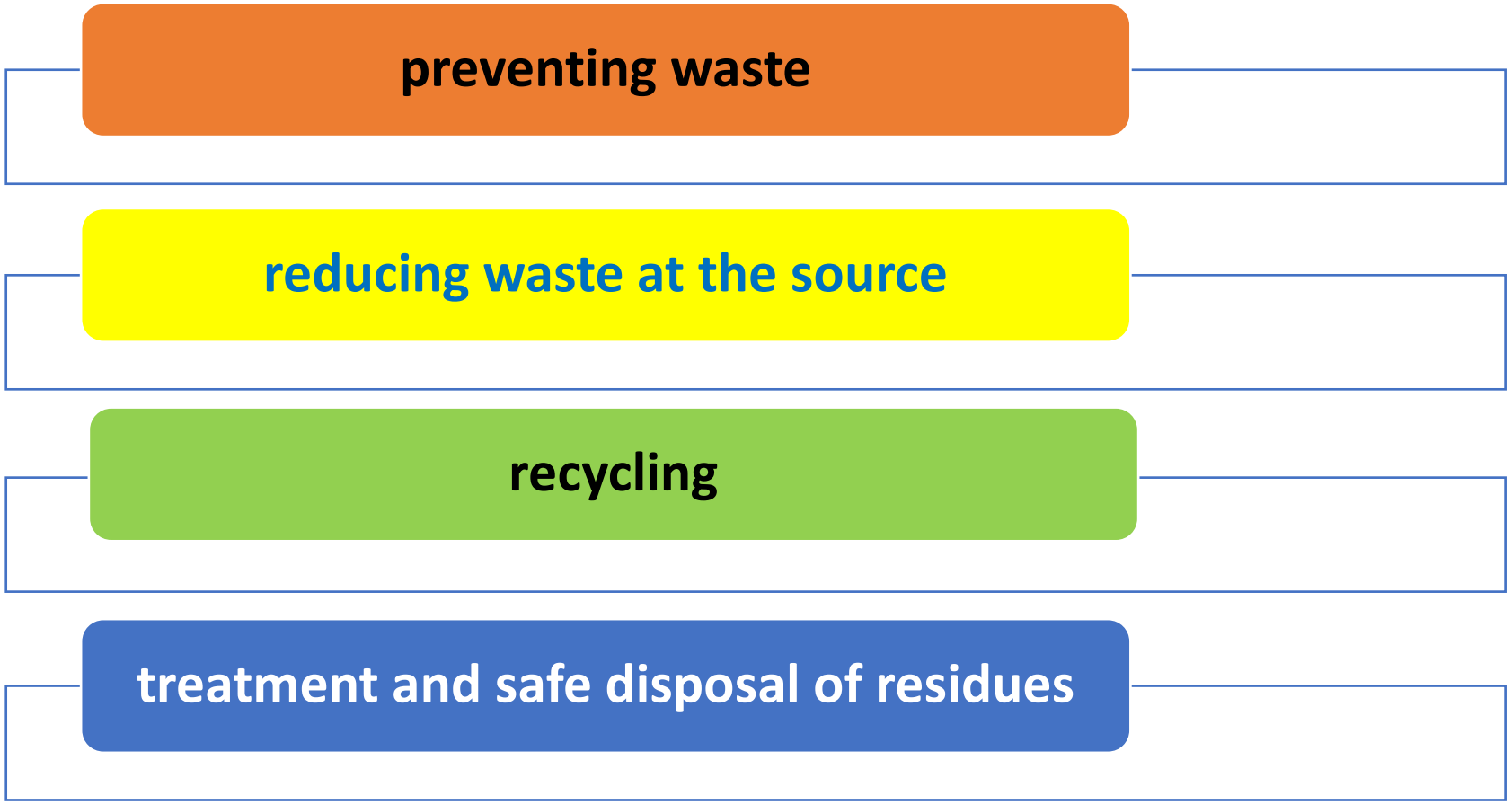
medicine/ unused drugs

cytotoxic/ cytostatic products

mixt municipal waste/non hazardous

dental

- It is necessary **to treat this type of waste** before the disposal of medical waste, to **avoid the negative impact** on the environment and health.



- **Proper training and adherence to guidelines are crucial** for the safety of healthcare workers, the public, and the environment.
- Some examples of reuse the non-hazardous waste:

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- The **impact** on the environment and health **of medical waste** is **very dangerous** and can be as:

**Fungal and bacterial infections**

Toxic elements producing poisoning

**Release of toxins into the atmosphere**

Bioaccumulation

**Leaching to the soil and underlying aquifers**

Leaving a footprint on the environment

Destruction of habitats

# Why do we need to treat medical waste?

# 1. Preventing the spread of antibiotic-resistant microorganisms

- **Medical waste may contain bacteria** that have developed **resistance to antibiotics.**

- If this waste is not properly treated, **microorganisms can end up in soil, water, or in contact with people and animals.**

**ARGUMENT: Antimicrobial resistance is considered by the World Health Organization to be one of the greatest global threats to health.**

**Proper management of medical waste helps limit the spread of these pathogens.**

# 2. Protecting water and sewage infrastructure

- Expired medications, chemicals, and improperly disposed disinfectants can end up in wastewater systems.

**ARGUMENT: Many wastewater treatment plants are not designed to completely remove pharmaceutical compounds, which can lead to contamination of water resources and long-term effects on ecosystems.**

# 3. Safety of workers outside the healthcare system

- It's not just doctors and nurses who are at risk.
- **Employees in sanitation, transportation, recycling and waste treatment can suffer accidents or infections.**

**ARGUMENT: An incorrectly disposed syringe can cause needlestick injuries, accidents, and exposure to dangerous pathogens such as hepatitis B, hepatitis C, or HIV.**

# 4. Preventing the illegal reuse of medical supplies

- In certain situations, **improperly disposed medical materials can be recovered and illegally reintroduced onto the market.**

**ARGUMENT: Reusing disposable syringes, containers or equipment can lead to outbreaks of infection and endanger public health.**

# 5. Maintaining public confidence in the healthcare system

- **The way medical waste is managed reflects the level of responsibility of medical institutions.**

**ARGUMENT: The discovery of abandoned medical waste in public spaces can seriously affect the image of hospitals and the population's trust in health services.**

# 6. Long-term cost reduction

- **Proper waste treatment involves costs, but improper management can generate much higher costs.**

**ARGUMENT: Cleaning contaminated areas, treating infected people, and sanctioning institutions can far exceed the costs of prevention.**

# 7. Compliance with legal and ethical obligations

- Medical facilities have a responsibility **to not produce negative effects on the community.**

**ARGUMENT: Medical waste management is not only a legal requirement, but also a moral obligation towards patients, employees and future generations.**

# 8. Supporting sustainable development

- **Not all medical waste is hazardous.**
- Some of it can be recycled or recovered for energy after treatment.

**ARGUMENT: Proper separation and treatment reduce the amount of waste that ends up in landfills and allow the recovery of valuable resources.**

- **MEDICAL WASTE IS NOT JUST A HYGIENE PROBLEM.**

- **IT INFLUENCES PUBLIC HEALTH, WORKER SAFETY, WATER QUALITY, THE ECONOMY AND EVEN SOCIETY'S TRUST IN THE MEDICAL SYSTEM.**

- **THAT'S WHY TREATING IT IS NOT AN OPTION, IT IS A NECESSITY**

# SO WHAT ARE THE SOLUTIONS FOR A CLEANER WORLD?

There are several types of processes that define the treatment of medical waste, the last is a supplement for the others:

- **Thermal**
- **Chemical**
- **Irradiative**
- **Biological**
- **Mechanical**

# A. THERMAL PROCESSES

- ❑ **at low temperatures**

- ❖ **steam** (autoclave, microwaves)
- ❖ **hot air** (convection, combustion, infrared heat)

- ❑ **at high temperatures**

- ❖ **incineration** (combustion, pyrolysis and/or gasification)

## B. CHEMICAL PROCESSES

- **addition of disinfectants** (chlorine dioxide, sodium hypochlorite, ozone, alkaline hydrolysis, peracetic acid)

- **encapsulation or solidification**

## C. IRRADIATIVE PROCESSES

- **UV rays, electron beams**

## D. BIOLOGICAL PROCESSES

- Enzymes

## E. MECHANICAL PROCESSES

- shredding

## F. BURIAL

- sanitary landfills, trenches, pits