



# Waste Management Programmes

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# Objectives



- ❑ Hazardous waste definitions and characteristics
- ❑ Hazardous waste categories
- ❑ How to safely manage various types of wastes:
- ❑ Occupational health and Safety in Waste Management
- ❑ Learn the importance of hazardous waste minimization.



# Definitions



❑ **Waste** is any “*discarded material*” that is not excluded from the definition of hazardous waste.

❑ **Discarded Material** is material that is “*abandoned,*” “*recycled*” or inherently “*waste-like.*”

# Hazardous waste definition



A waste, or combination of wastes, which because of its quantity, concentration, or physical characteristics may either cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating illness, pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

# Why Manage Hazardous Waste?



- ☐ To protect human health & the environment.
- ☐ To minimize the generation of hazardous waste.
- ☐ Hazardous Waste Management Programs are designed to meet or exceed compliance with National and/or local Regulations

# Responsibilities

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It is the responsibility of the person generating the waste to ensure that all procedures are followed to ensure safe and environmentally responsible disposal of the waste.

# Hazardous Waste Characteristics



Waste that satisfies the following definitions can be classified as hazardous waste.

1. **Hazardous by characteristic**

- ☐ Flammable
- ☐ Oxidizer
- ☐ Corrosive
- ☐ Reactive
- ☐ Explosive
- ☐ Toxic ( $LD_{50} < 500\text{mg/kg}$ )

2. **Unknown chemical wastes** are considered hazardous unless proven otherwise by testing.

# Hazardous Waste Categories



Waste category	Description and examples
Infectious waste	Waste suspected to contain pathogens e.g. laboratory cultures; waste from isolation wards; tissues (swabs), materials, or equipment that have been in contact with infected patients; excreta.
Pathological waste	Human tissues or fluids e.g. body parts; blood and other body fluids; fetuses.
Sharps	Sharp waste e.g. needles; infusion sets; scalpels; knives; blades; broken glass.
Pharmaceutical waste	Waste containing pharmaceuticals e.g. pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals (bottles, boxes).
Genotoxic waste	Waste containing substances with genotoxic properties e.g. waste containing cytostatic drugs (often used in cancer therapy); genotoxic chemicals.



# Hazardous .....



<b>Waste category</b>	<b>Description and examples</b>
<b>Chemical waste</b>	Waste containing chemical substances e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed; solvents
<b>Wastes with high content of heavy metals</b>	Batteries; broken thermometers; blood-pressure gauges; etc.
<b>Pressurized containers</b>	Gas cylinders; gas cartridges; aerosol cans
<b>Radioactive waste</b>	Waste containing radioactive substances e.g. unused liquids from radiotherapy or laboratory research; contaminated glassware, packages, or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides; sealed sources

# Waste Management Processes

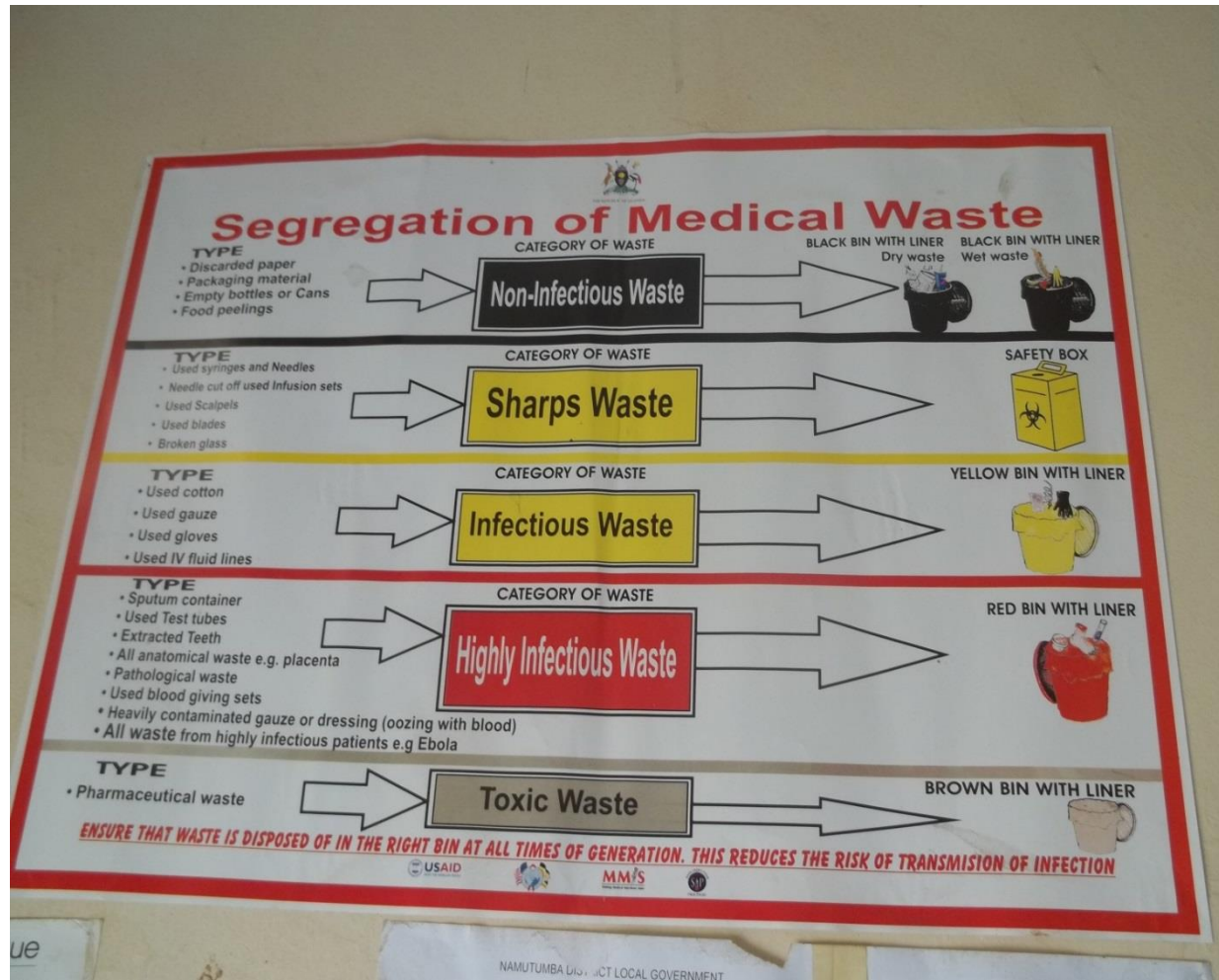


# What is Waste Segregation?



- ❑ Segregation means the separation of the entire waste generated in a facility e.g. hospital in defined, different waste groups according to the specific treatment and disposal requirements.
- ❑ Only a segregation system can ensure that the waste will be treated according to the hazards of the waste and that the correct disposal routes are taken and that the correct transportation equipment will be used.





# Importance of Segregation



- ❑ Segregation is the key to any effective waste management
- ❑ Without effective segregation system, the complete waste stream must be considered as hazardous
- ❑ Foundation of an Occupational Health and Safety Programme, Recycling and Cost Reduction.

# Chemical Waste Management



# Chemical Safety: Chemical Hygiene Plan



- ☐ The Chemical Hygiene Plan (CHP) is the foundation for a chemical safety program in a laboratory
- ☐ It has many components and is specific to each laboratory



# Chemical Hygiene Plan (CHP) .....



## ☐ CHP Components:

- ❖ Material data safety sheets

## ☐ Chemical inventory

- ❖ Chemical storage
- ❖ Personal Protective Equipment
- ❖ Engineering and Ventilation Controls
  - Chemical Fume Hoods
  - Biological Safety Cabinets
  - Emergency Shower and Eyewashes
- ❖ Job hazard analysis/Risk Assessment Reports



# Material Data Safety Sheets (MSDS)



- ☐ Definition: Health-related, chemical- and brand-specific information
  - Hazard type
  - Suggested PPE
  - First Aid
  - Toxicology
  - Physical chemistry (flash point, boiling point, etc.)
- ☐ Should be immediately accessible to laboratory workers
- ☐ Should be one for every chemical in each laboratory

# Segregation and Chemical Wastes



- ❑ Incompatible chemical wastes must be segregated as far as possible to reduce the risk of a dangerous reaction.
- ❑ It is also desirable to segregate compatible materials (where practical) to improve the potential for reuse or recycling.
- ❑ For each chemical to be disposed of refer to the MSDS to be aware of the safety and environmental considerations.

# Packaging and Labeling



- ☐ Approved containers must be used
- ☐ All waste containers and packages must be properly labeled accordingly: use proper chemical names on all labels. Acronyms, trade names, or chemical formulas are not acceptable.
- ☐ Waste that is inadequately packaged or labeled may be rejected by the hazardous waste contractor and not collected for disposal.

# Liquid Chemical Hazardous Waste Collection



- ☐ Hazardous wastes shall be collected in containers which are compatible with the intended contents and which are in good condition.
- ☐ Materials placed in the same collection container shall be compatible with all other materials in the container.
- ☐ Containers shall be labeled, with the date of first accumulation noted.
- ☐ All chemical reactions should be complete prior to introduction into collection containers.
- ☐ Whenever possible, individual substances should to be collected separately to increase disposal options and reduce cost.

# Liquid Chemical Hazardous Waste



- ☐ Collection containers shall be kept securely closed except when adding hazardous material.
- ☐ Containers to be submitted for disposal must not exceed 20 liters (5 liter for corrosives), unless prior approval has been obtained from your Institutional waste management.
- ☐ Secondary containment is strongly recommended for all liquid hazardous wastes.
- ☐ Hazardous wastes shall not be accumulated longer than 3 months at satellite sites such as laboratories.

# Storage



- ☐ Store chemical waste according to compatibility with other chemical waste in the storage area.
- ☐ Never store incompatible chemical waste in a manner that will allow reactions to occur in the event of a spill or release (refer to MSDS).
- ☐ Store waste chemicals for the shortest possible length of time. Do not store waste chemicals for extended periods.
- ☐ *Security* – areas used for the storage of hazardous waste must be secured by key or swipe card whenever the area is unsupervised.



# Storage and Transportation of Chemical Waste





# On-site Waste Treatment



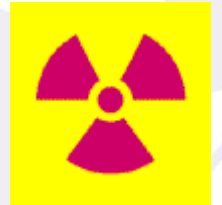
- ☐ It may be possible to neutralize acidic, alkaline, oxidizing, or reducing wastes in laboratories where staff have the required experience and technical competence. If the end product is not hazardous, then it may be discarded to sewer (drain).
- ☐ Are there acceptance criteria for discharge to sewer in your country????



# Radioactive Waste



- ☐ Radioactive waste must never be placed in regular garbage bins. It is the responsibility of the Biosafety Officer/Principal Investigator to ensure that waste is properly segregated, identified, and labeled for disposal.
- ☐ Affix a Radioactive Waste Label to the container prior to its use.
- ☐ Avoid storing radioactive waste in the laboratory for decay purposes.
- ☐ Follow your National and/or local Guidelines on Managing Radioactive waste





# Bio-hazardous Waste

# Bio-hazardous Waste



- ❑ A Biohazard refers to a biological substance that may pose a threat to the health and safety of humans, animals or the environment. Anything that comes in contact with a Biohazard is normally deemed contaminated.
  
- ❑ Different categories of Bio-hazardous waste:
  - ✓ medical waste
  - ✓ animal carcasses
  - ✓ animal husbandry
  - ✓ laboratory waste
  - ✓ Sharps
  - ✓ blood soaked towels or gauze
  - ✓ petri dishes or
  - ✓ any contaminated laboratory ware.



# Animal waste



- ☐ Animal bedding, carcasses, and tissue should be placed in biohazard bags by the research staff.
- ☐ All animal bedding should be autoclaved before being placed in medical waste bins by animal care staff and disposed of by incineration.
- ☐ Bagged animal carcasses and tissue can be placed in storage freezers or removed by animal care or lab staff to the incineration facility.
- ☐ Non-infectious: waste that is not contaminated with radioactivity or chemicals can be directly disposed of into a regular garbage bin.

# Microbiological Laboratory Waste



- ☐ Definition: This type of waste includes laboratory cultures, weigh boats, gloves, paper towels, absorbent pads, bench top covers, plastic products (tubes, flasks, petri dishes), non penetrable waste (metal pans, blunt objects), etc.
- ☐ This waste should be autoclaved and then disposed of with general waste provided it is contained in a package that is labeled decontaminated and there is no evidence of a recognizable Biohazard sign anywhere.
- ☐ Send autoclaved waste to the incineration facility.

# Decontamination

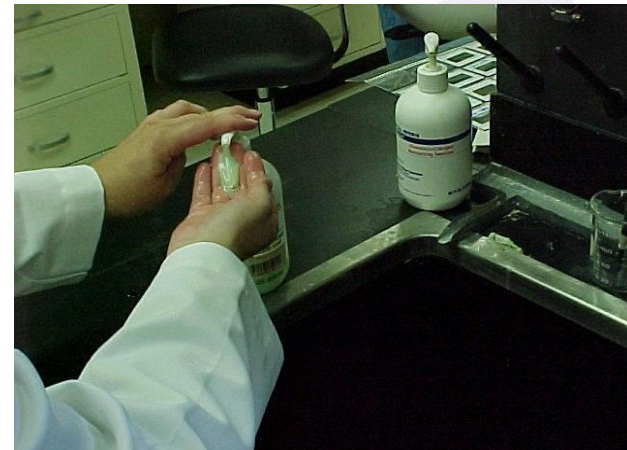


- ❑ To render the object/material safe by reducing or removing the bio-burden
- ❑ Methods
  - ✓ chemical ... match, contact time
  - ✓ physical ... Heat, steam and pressure
  - ✓ incineration
  - ✓ other choices, i.e. shredding + chemical

# Personal Decontamination



- ❑ Wash hands for 20-30 seconds after:
  - ✓ Handling infectious materials or animals
  - ✓ Removing gloves
  - ✓ Before leaving lab





# Microbiological Laboratories



- All potentially contaminated waste materials (e.g., gloves, lab coats, etc.) from laboratories are decontaminated before disposal or reuse.





# Storage, Transport and Spills



- ☐ Plastic bags for the collection of clinical and biological wastes other than sharps should have sufficient strength to safely contain the waste class they are designated to hold
- ☐ Bio-hazardous waste spills must be cleaned up immediately unless unsafe to do so.
- ☐ Clean-up and decontamination must be carried out in accordance with the written operating procedures of the laboratory and in accordance with your Institutional Guidelines, local and country regulations.

# Biological Waste Treatment



There are different methods of disposal of biohazard materials which include:

- ☐ Autoclaving
- ☐ Chemical Inactivation/Disinfection
- ☐ Incineration

# Good Practices



- ☐ Never place lab waste into office waste containers
- ☐ Line discard containers with autoclave bag
- ☐ Decontaminate discard pans before they leave the lab:
  - ✓ Disinfect outside
  - ✓ Label
  - ✓ Tape ends with autoclave tape
  - ✓ Secure for transport to autoclave



# Autoclaving



- ☐ An autoclave testing program must be routinely administered according to the manufacturer's recommendations. Such tests may consist of culture, tape color change or other recommended procedure.
- ☐ Autoclave testing, repair and use records must be properly maintained.
- ☐ Annual testing of Autoclaves by a competent authority is a requirement in several countries.

# Incineration



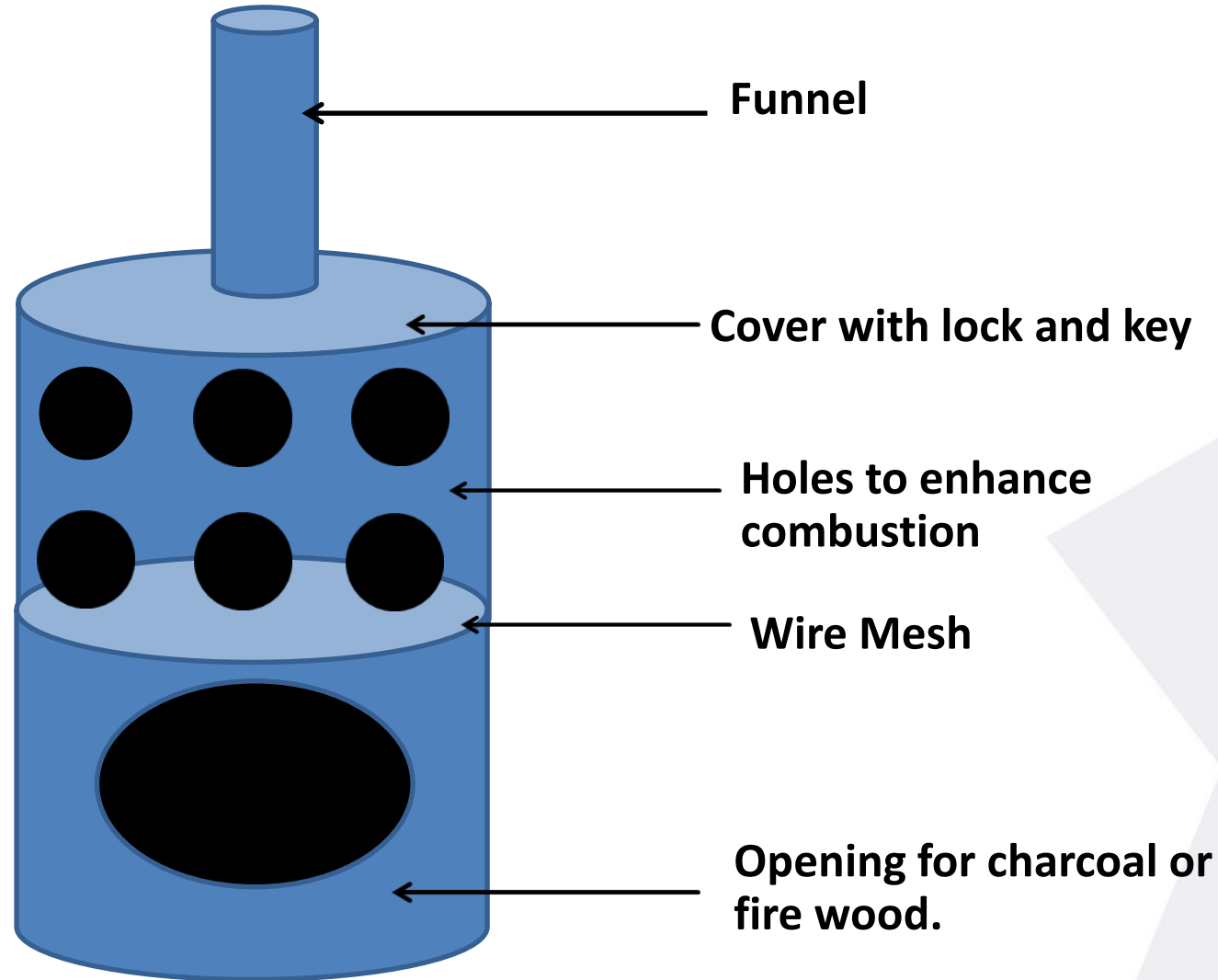
- ☐ Thermal treatment
  - ☐ Can destroy pathogens and toxins by high temperatures
- ☐ Reduce volume of original waste by 95+%
  - ☐ Significantly reduces amount of waste sent to landfill
- ☐ Waste converted into ash, flue gases, and heat
- ☐ Flue gases may be required to be cleaned of pollutants before released to atmosphere
- ☐ Incinerators need to be properly designed, constructed, operated, and maintained to protect environment and human health.

# Incinerator “Best Practices”



- ☐ Monitor Waste Types
- ☐ Ensure Proper Operating Temperatures
- ☐ Optimize operation schedule

# Nigerian Incinerator





# Sharps



# Needles and sharps



- ☐ Needles (including suture needles)
- ☐ Syringes (with or without needles)
- ☐ Needles from vacutainers
- ☐ Needles with attached tubing
- ☐ ALL blades (razors, scalpels, etc.)



# Glassware



- ☐ Any item that is not a sharp and/or has not been in contact with infectious agents, or has not been used in animal or human patient care or treatment at a medical, research or industrial laboratories, but could potentially puncture a regular waste bag and pose a hazard to waste handlers.

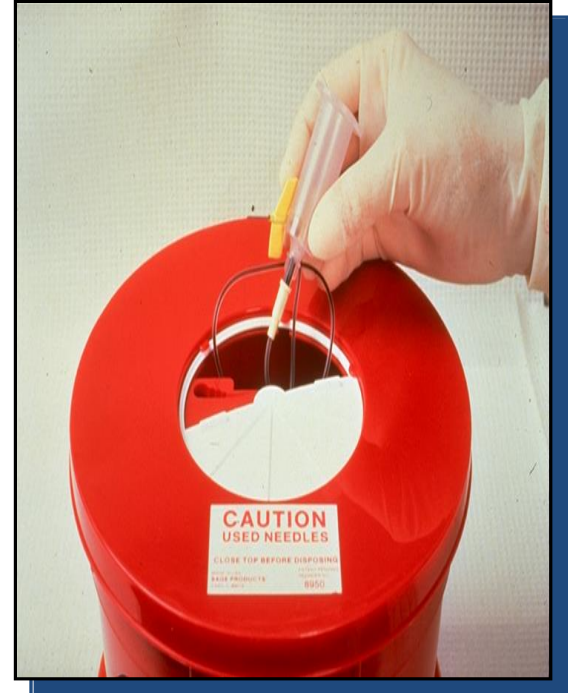


- ☐ This includes non-infectious slides, cover slips, vials, Pasteur pipettes, empty chemical reagent bottles and broken or fragile glass or plastic.

# Sharps



- ❑ Segregate wastes  
(chem, bio, rad, sharps)
- ❑ Place sharps into  
“sharps” container
- ❑ Effectively  
decontaminate
  - ✓ Autoclaving, chemical  
disinfection



# Handling and Transportation



- ☐ Packaged to remove for incineration
- ☐ Protect personnel handling waste





# Gases

# Collection of Gases



- ☐ Empty containers should also be marked with "EMPTY" or "MT".
- ☐ Compressed gases should not be transferred from one container to another except by the manufacturer or distributor.
- ☐ Do not exchange regulators or other appliances used with one gas with similar equipment used with other gasses. Oils and lubricants should not be used on fittings for oxygen or other oxidizing gasses.



# Waste Minimization



Examples of ways in which waste minimization can be achieved include:

- ☐ substituting a hazardous material used in a process with a non-hazardous material
- ☐ process changes
- ☐ reducing the amount of hazardous materials used
- ☐ recovering and reusing materials

# Key Messages



- Hazardous waste are managed to protect human health & the environment.
- Only a segregation system can ensure that the waste will be treated according to the hazards of the waste and that the correct disposal routes are taken and that the correct transportation equipment will be used
- The outcome of waste disposal must be safe





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# Thank you