



Empowered lives.  
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## Reducing UPOPs and Mercury Releases from The Health Sector in Africa

# *Module 50*

## *National HCW planning - healthcare waste treatment strategy*

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INVESTING IN OUR PLANET



# What do we want?

- ▶ The safe collection, transportation and treatment of all different kind of hazardous Health Care Waste (HCW)
- ▶ Tracing and control of these waste streams
- ▶ Environmentally correct management & treatment of hazardous HCW:
  - Infectious waste (about 70-80%)
  - Chemical & Pharmaceutical waste (about 10-15%)
  - Pathological waste (about 5-10%)
  - Other hazardous waste (< 5%)
- ▶ Final disposal of the treated waste
  - Including generated by-products
- ▶ Consideration of environmental aspects!
- ▶ Consideration of economical aspects!



Illegal disposed of healthcare waste (sharps)



# Characterization main waste streams I:

## ► Infectious waste:

- Biological active, “living” waste which may contains pathogens like fungi, viruses, bacteria's, etc.
- Normally will include so called “sharp” items
- Storage times are limited (1-7 days, depending on Temp.)
- Low density (100 – 120 kg/m<sup>3</sup>), high transport total volume

## ► Task of treatment

- Target: Complete destruction of all form of microbial life.
- Accepted:  $\geq 99,9999\%$  reduction (one millionth survival probability) of the pathogens = sterilization

## ► International recommended treatment methods:

- Steam treatment (Autoclaving)
- Oxidation (Hospital waste incineration,  $T = >800^{\circ}\text{C}$ )



# Characterization main waste streams II:

- ▶ Chemical & Pharmaceutical waste:
  - Main waste groups are photo-chemicals (up to 75%)
  - Can include typical laboratory waste (halogenated and non-halogenated solvents, acids, cyanides, etc.)
  - Max. storage times can be relatively long
  - Medium to high density ( $\geq 500 \text{ kg/m}^3$ ), low transport volume
- ▶ Task of treatment
  - Recovery of valuable materials (e.g. Silver – Ag)
  - Rendering the waste harmless for humans and the environment.
- ▶ International recommended treatment methods:
  - Chemical-Physical treatment (e.g. electrolysis)
  - Oxidation (Industrial waste incineration ,  $T = >1,100^\circ\text{C}$ )



# Characterization main waste streams III:

- ▶ Pathological waste:
  - “Risk” waste out of ethical reasons
  - Storage times are limited due to possible gas production
  - Normally does not contain pathogens
  - High density waste ( $\geq 700 \text{ kg/m}^3$ ), low transport volume
- ▶ Task of treatment
  - Target: Rendering the waste unrecognizable for the public
- ▶ International recommended treatment methods:
  - Cremation
  - Burying
  - Oxidation (Hospital waste incineration ,  $T = >850^\circ\text{C}$ )



# Characterization main waste streams IV:

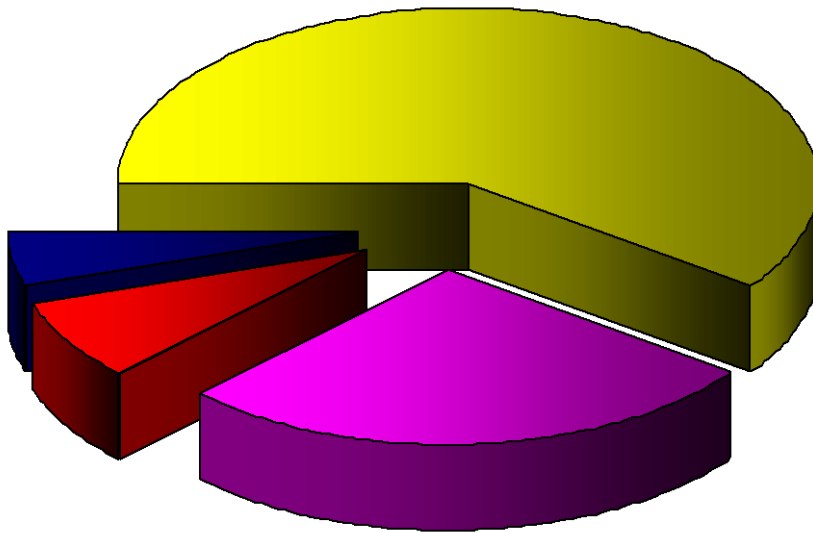
- ▶ Other hazardous waste (will only partly be generated):
  - Heavy metal waste (Mercury, etc.)
  - Radioactive waste (Mostly excluded from the typical healthcare waste streams)
  - Medium density ( $\geq 400 \text{ kg/m}^3$ ), very low transport volume
- ▶ Task of treatment
  - Target: Minimizing of environmental impacts
- ▶ International recommended treatment methods:
  - Oxidation (Industrial waste incineration,  $T = >1,100^\circ\text{C}$ )
  - Recovery and Recycling (Heavy metals)
  - Long term storage



# Weight versus Volume

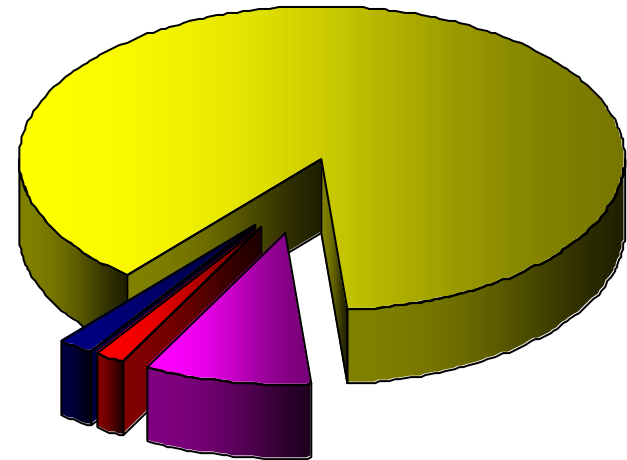
- ▶ For the planning of a disposal logistic, esp. the volume of the to be transported hazardous waste has to be observed!

Haz. HCW in Terms of Weight



■ Infectious HCW ■ Chemical HCW ■ Pathological HCW ■ Other Haz. HCW

Haz. HCW in Terms of Volume



■ Infectious HCW ■ Chemical HCW ■ Pathological HCW ■ Other Haz. HCW

- ▶ It is obvious, the low density of the infectious waste demands a treatment relatively close to the place of generation to minimize logistics costs (<50 km). Other hazardous HCW streams could be transported for longer distances.

# Strategy Development – Points to obey

## ▶ Costs

- Necessary investment costs (Full costs analysis, including so-called “hidden costs”)
- Operation costs (including overhead costs, packaging, transportation and costs for the final disposal of residues)

## ▶ Logistic aspects

- Highways, road conditions, climate
- Volume (density) of the waste stream
- Packaging, Maximum storage time

## ▶ Others

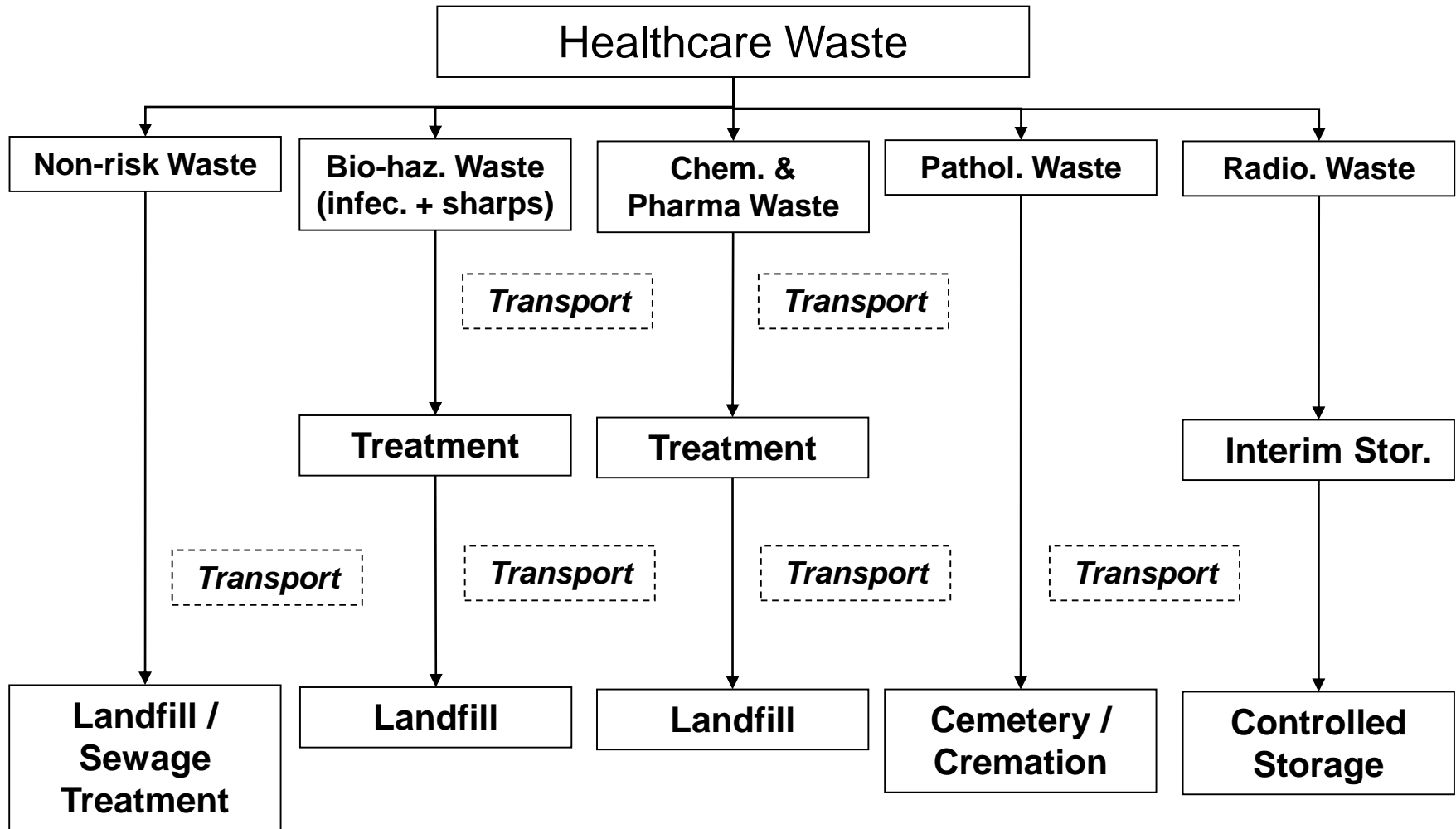
- Existing infrastructure (water, electricity)
- Availability of trained personal
- Maintenance aspects





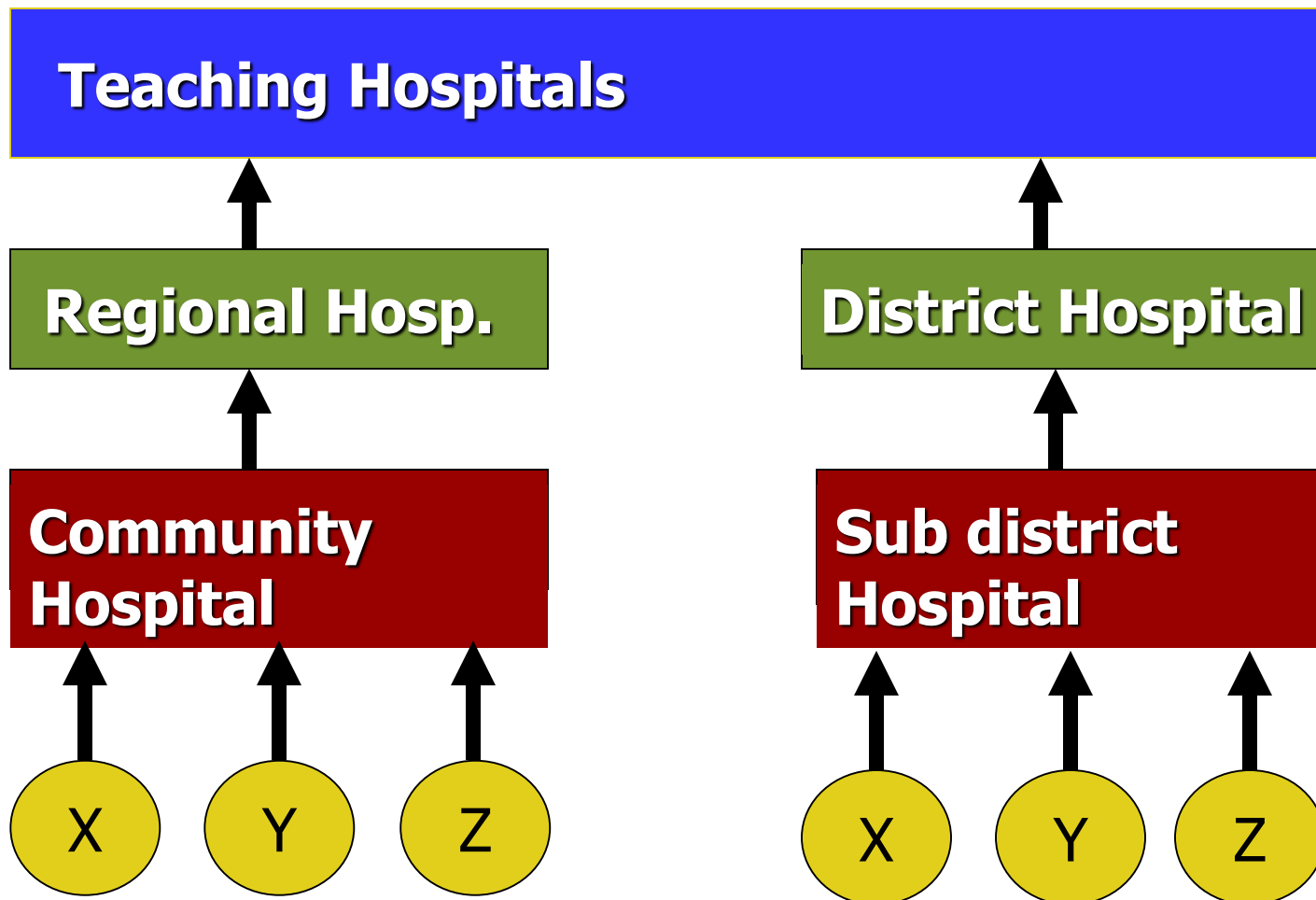


# Waste stream strategy





# Can we use the refferal system of healthcare for waste?





# Sample Strategy

## ► Targets

- Minimizing of the total disposal costs (Invest + Operation costs) and of the total environmental impacts
- Minimizing of the transportation risks (Proximity Principle) and the logistic costs

## ► Basic Strategy

- Treatment of difficult to treat hazardous waste with a high density on provincial or national level, if possible in combination with industrial hazardous waste or by co-incineration (cement)
  - Waste streams: Chemical waste (e.g. photo chemicals), pharmaceutical waste, other waste.
- Treatment of easy to treat and low density hazardous waste which cannot be stored on provincial or district level
  - Waste streams: Infectious waste, sharps, pathological waste



# Possible Strategy

## Bio-hazardous waste:

Collection frequency:

- Regularly (at least every second day)

Density of the waste:

- Low (120 kg/m<sup>3</sup>)

Waste volume (per pick up / waste stream)

- Relatively high

## Chemical/Pharmaceutical waste:

Collection frequency:

- On demand, can be interim stored on-site for a longer tem

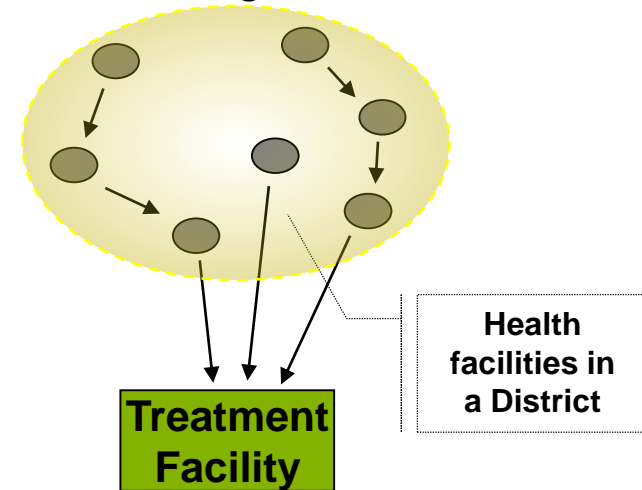
Density of the waste:

- Medium to high (300 – >1000 kg/m<sup>3</sup>)

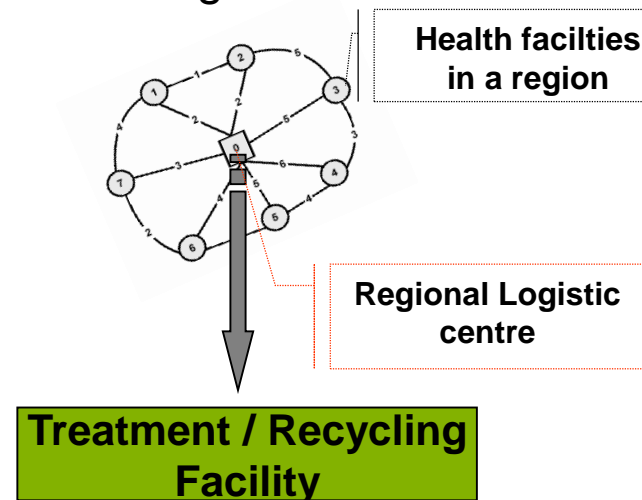
Waste volume (per pick up / waste stream)

- Low

### One-stage structure

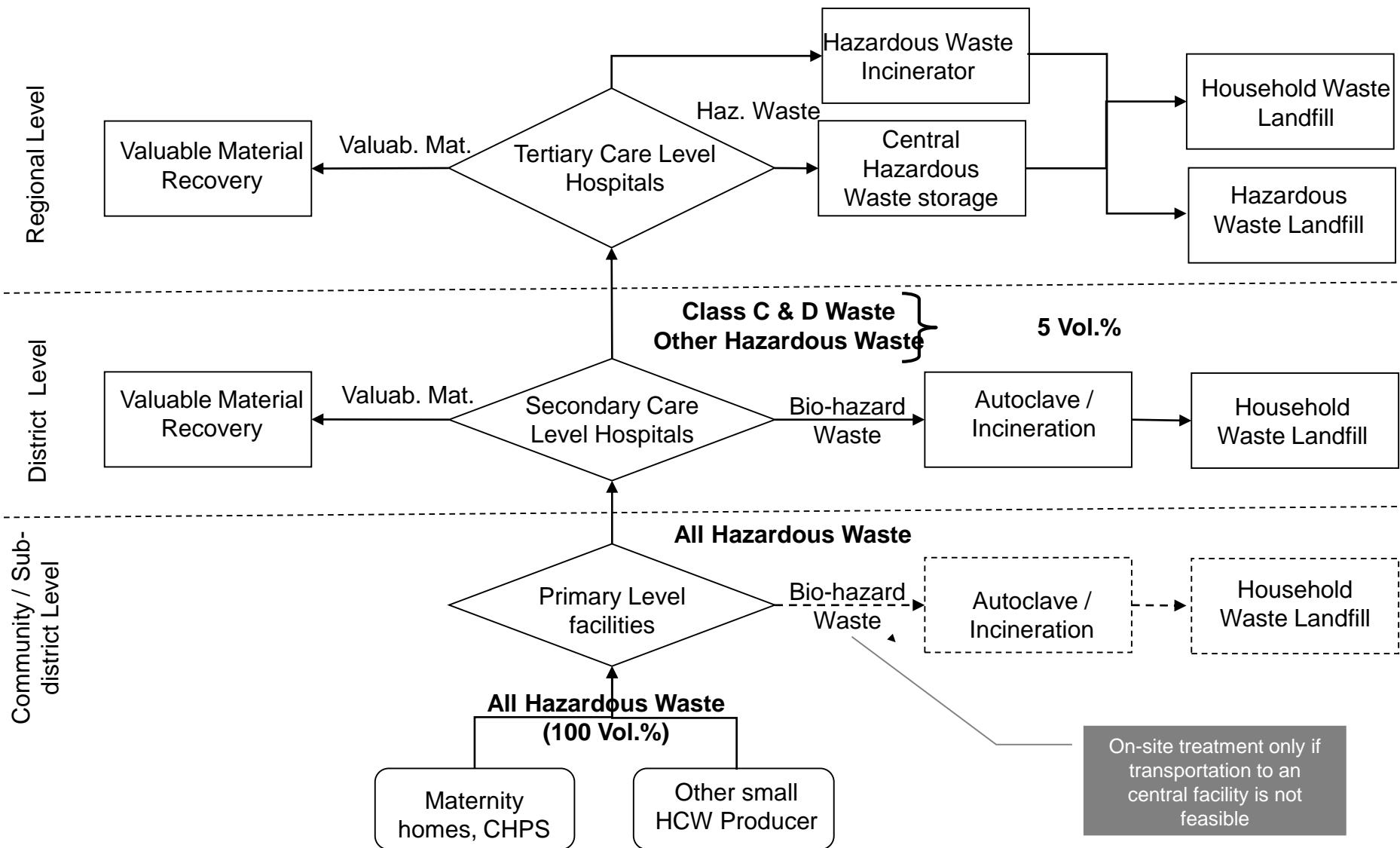


### Two-stage structure



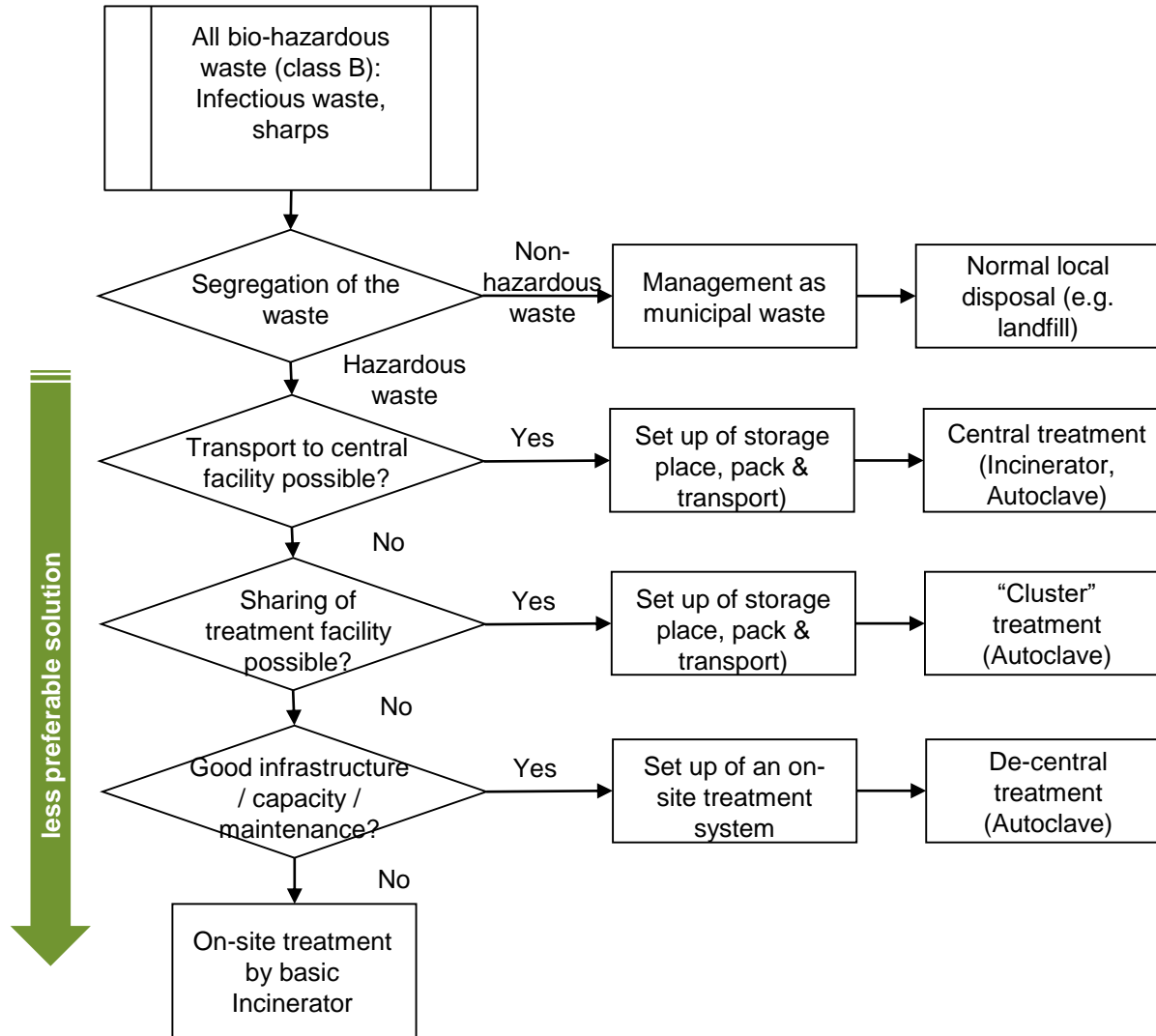


# Overview – Simplified Strategy



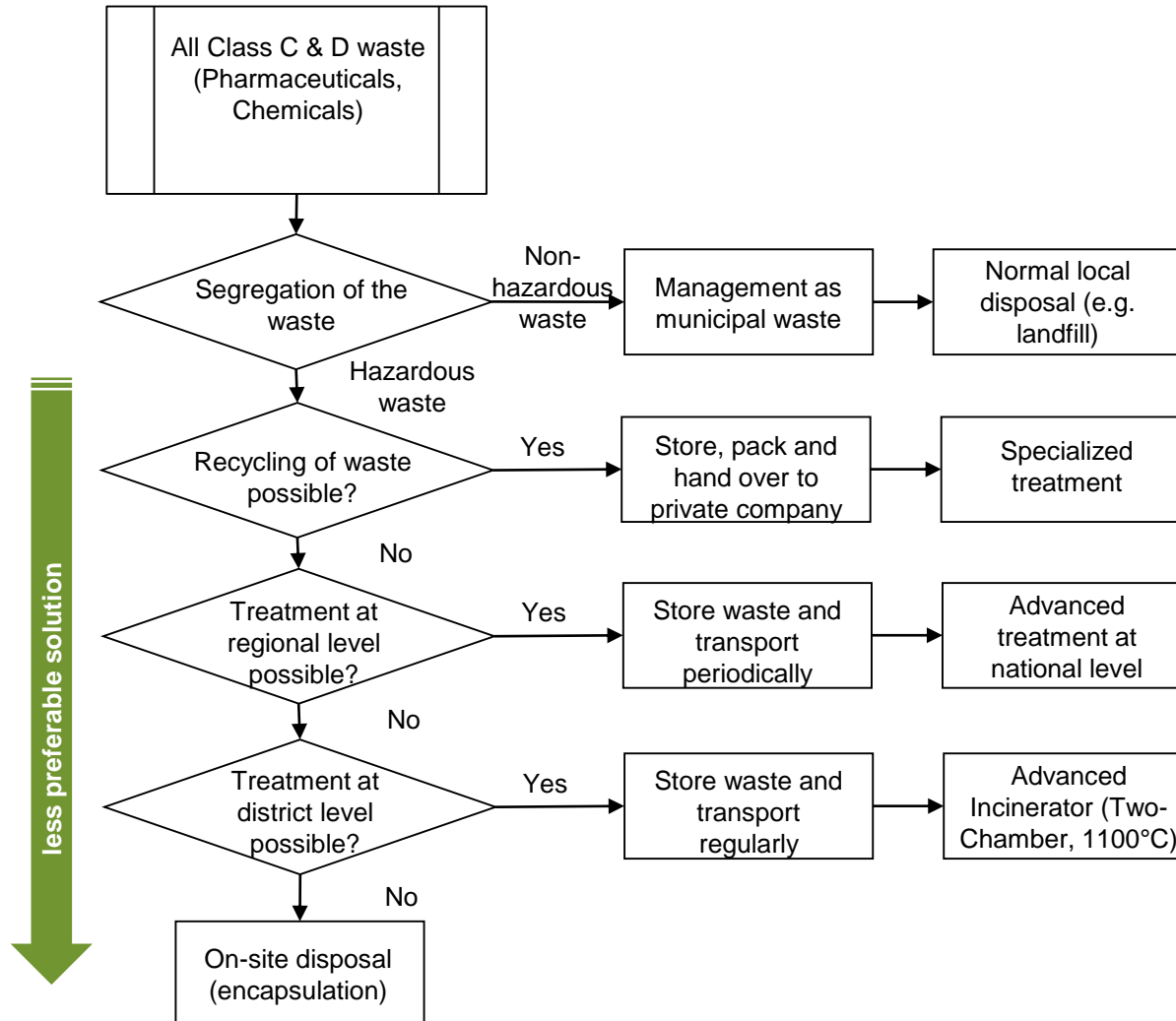


# Decision making: Bio-hazardous waste



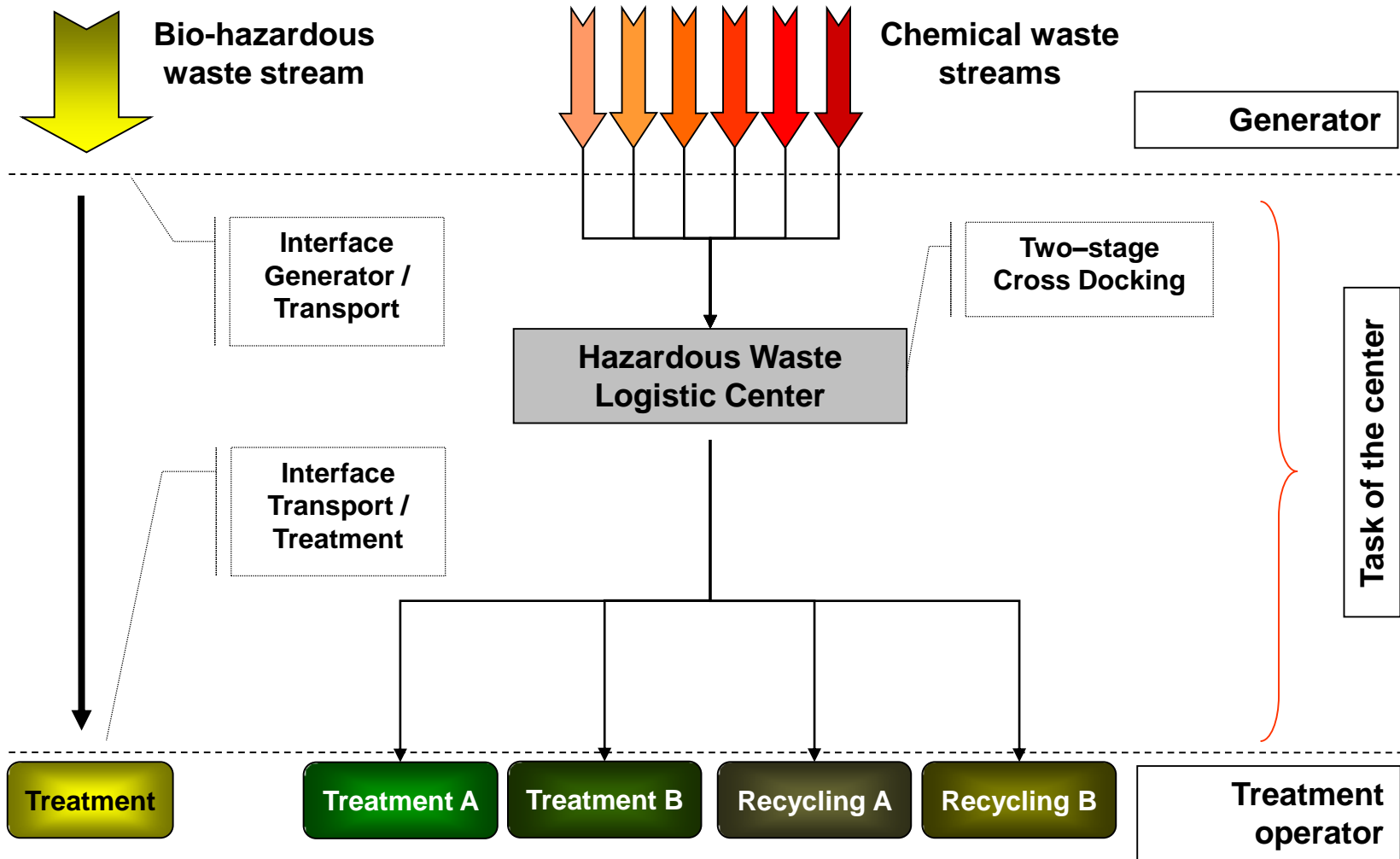


# Decision making: Pharma & Chemical waste





# Possible Chemical Logistic Strategy







# Decision making: Pathological waste

