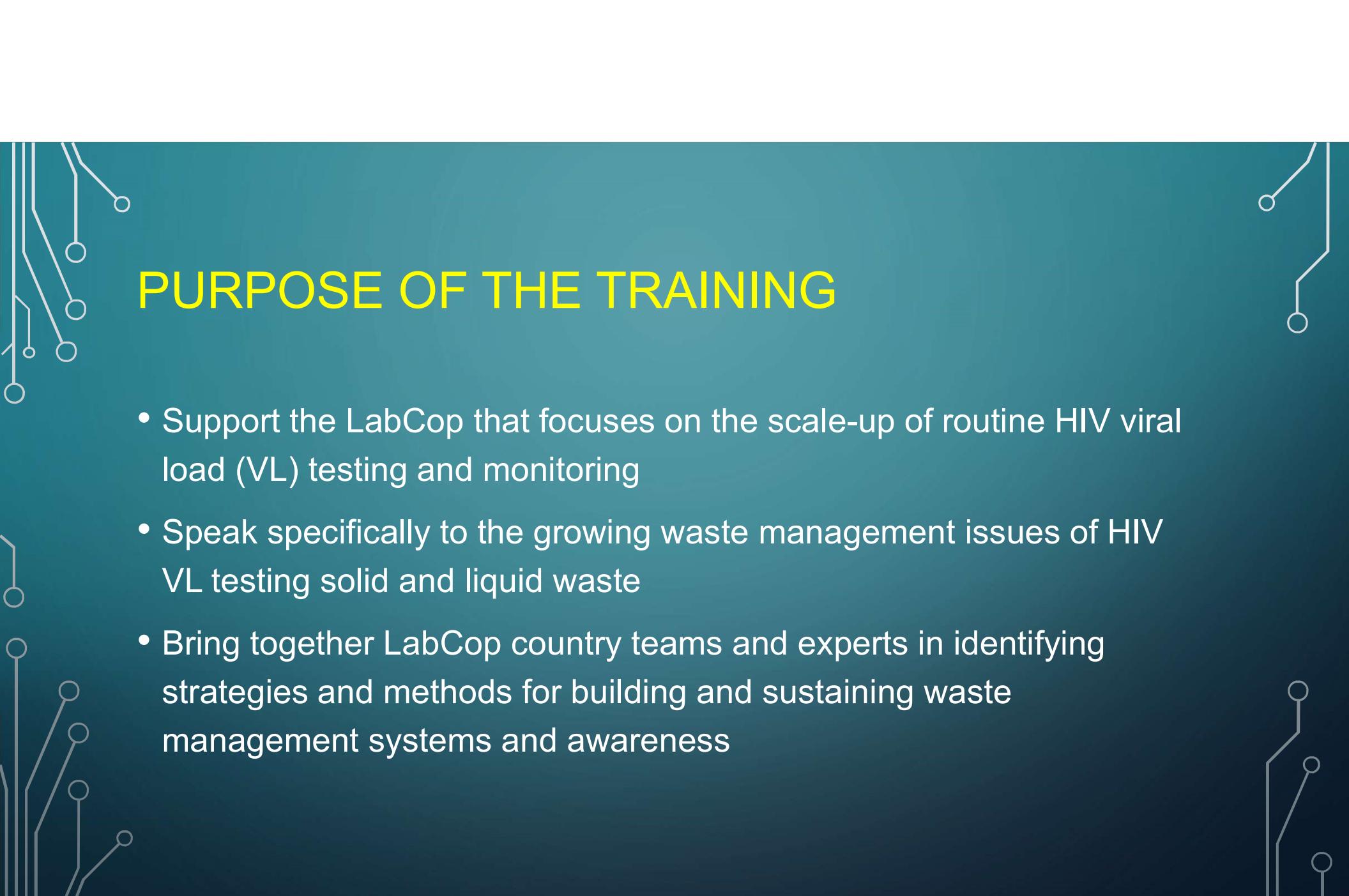




# **THE WHO BLUE BOOK: SAFE MANAGEMENT OF WASTES FROM HEALTH-CARE ACTIVITIES**

**LABORATORY AND HEALTHCARE WASTE MANAGEMENT**  
**TRAINING SESSION 2 : A COLLABORATIVE SHORT TERM TRAINING**  
**EFFORT CONDUCTED BY CDC INTERNATIONAL LABORATORY**  
**BRANCH (ILB), THE AFRICAN SOCIETY FOR LABORATORY**  
**MEDICINE (ASLM) LABCOP PROGRAM, AND THE GLOBAL FUND**

Presented by: David Bressler, MS, CBSP, (SM)NRM  
International Laboratory Branch  
CDC, Division of Global HIV and TB  
Email: [dpb8@cdc.gov](mailto:dpb8@cdc.gov)



## PURPOSE OF THE TRAINING

- Support the LabCop that focuses on the scale-up of routine HIV viral load (VL) testing and monitoring
- Speak specifically to the growing waste management issues of HIV VL testing solid and liquid waste
- Bring together LabCop country teams and experts in identifying strategies and methods for building and sustaining waste management systems and awareness

# OUTLINE FOR THE SESSION

- Review of HIV VL waste disposal issues
- Overview of *WHO Safe Management of Wastes from Health-Care Activities*
- Potential remediation technologies and considerations
- High Level Next Step recommendations for VL waste management

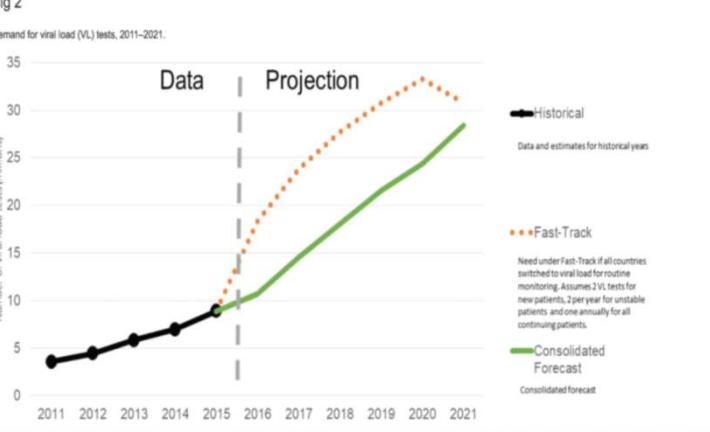
# VIRAL LOAD TESTING WASTE MANAGEMENT OVERVIEW

Forecasting the global demand for HIV monitoring and diagnostic tests: A 2016-2021 analysis

Fig 2

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Demand for viral load (VL) tests, 2011–2021.



- By 2020, more than 30 million HIV VL tests will be performed globally
- HIV VL molecular diagnostic testing produces potentially hazardous chemical waste, containing Guanidinium Thiocyanate (GTC)
- GTC can produce hydrogen cyanide gas when it comes in contact with an acid or oxidizer, such as bleach
- Thiocyanate is toxic to humans and animals and if untreated and poured down the drain can pollute waters and harm aquatic life

Habiyambere V, Dongmo Nguimfack B, Vojnov L, Ford N, Stover J, Hasek L, et al. (2018) Forecasting the global demand for HIV monitoring and diagnostic tests: A 2016-2021 analysis. PLoS ONE 13(9): e0201341. <https://doi.org/10.1371/journal.pone.0201341>



# VIRAL LOAD LIQUID WASTE COMPONENTS

Table 1. Waste Generated from Viral Load and EID/IVT Testing Platforms and Manufacturer's Disposal Recommendations<sup>1</sup>

Testing Platform	Liquid Waste Generated by Viral Load and EID/IVT Testing	Manufacturer's Recommendation for Liquid Waste Disposal	Potential Methods for Liquid Waste Disposal
<sup>2</sup> Roche CAP/CTM	~80% sodium citrate dihydrate ~5% guanidine thiocyanate ~2% proteinase ~5% isopropanol ~8% other/water	Do not mix reagents or liquid waste with bleach.	1. Encapsulation 2. High temperature incineration in a chemical compliant incinerator 3. Landfill 4. Filtration (novel) 5. Neutralization (novel)
<sup>2</sup> Roche 4800	0.6 – 0.12 M guanidine thiocyanate 0.6-0.9% Polydocalanol 0-0.4% Dithiothreitol Sodium Citrate 5-14 mM 2-8 mM tris buffer	Do not mix reagents or liquid waste with bleach.	
<sup>2</sup> Roche 6800/8800	0.7 – 0.9 M guanidine thiocyanate 0.8-1% Polydocalanol 0.3-0.4% Dithiothreitol Sodium Citrate ~13 mM ~0.6 mM Tris	Do not mix reagents or liquid waste with bleach.	
<sup>3</sup> Abbott m2000sp	~5% guanidine thiocyanate ~20% tris acetate ~1% ProClin ~1.5% Abbott microparticles (iron) ~1% non-ionic surfactant ~71.5% water	Do not mix reagents or liquid waste with bleach.	
Biomérieux <b>NucliSENS</b> EASYMAG/EASY Q	EASYMAG lysis buffer contains: 50-<60% guanidine thiocyanate 1-<3% triton X-100 surfactant	Avoid release to the environment. Dispose in accordance with all applicable regulations. Follow label warnings even when reagent containers are empty as there is potential retention of product residue.  It is the users' responsibility to ensure safe handling conditions, storage and disposal.	
<sup>4</sup> GeneXpert	Guanidinium Thiocyanate present in sealed test cartridges for both VL and EID/IVT. Also in sample reagent vial for EID/IVT.	Sealed test cartridge and any remaining sample reagent vial liquid should be triple packaged in leak proof container and placed in a hard-sided container. The container should then be destroyed by either high temperature burning (>1000°C), or by incineration. <b>Do not mix test cartridges or sample reagent vials with bleach.</b>	
<sup>4</sup> AlereQ	Guanidinium HCL	Decontaminate and dispose IAW all local, state and federal regulations	

1Country and/or local specific regulations and guidelines should be taken into account. 2Roche reagent cassettes contain hazardous chemicals and disposal of expired or unused cassettes should also be in accordance with Country and/or local specific regulations and guidelines. 3Unused Abbott sample preparation reagents should be disposed with the liquid waste from the Abbott m2000sp instrument. 4Waste contained in sealed cartridge.

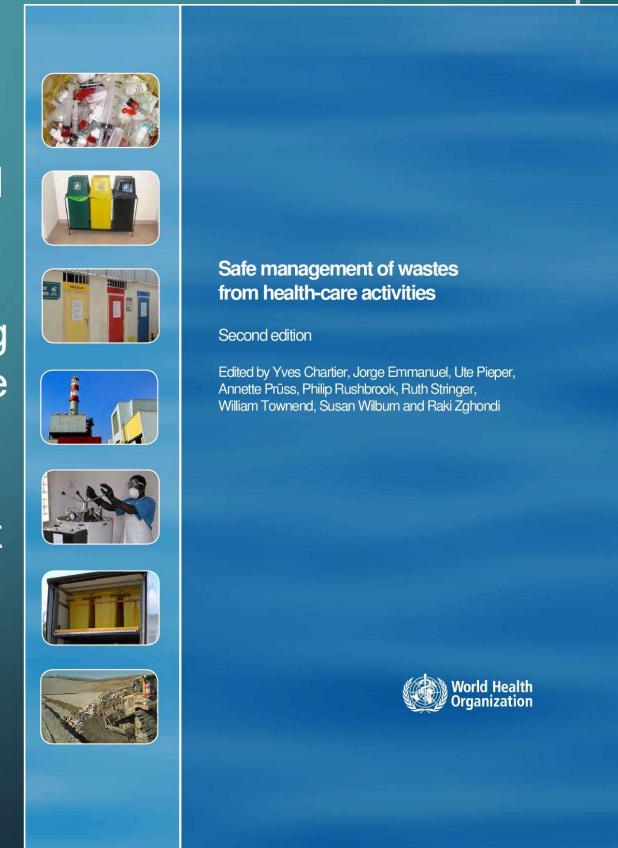
- Each current VL testing platform contains at least some percentage of GITC in the waste volume
- Manufacturer's recommendations for disposal are not very detailed



# WHO Publication: Safe Management of Wastes from Health-Care Activities, 2<sup>nd</sup> Ed, 2014

WHO official guidance document on all types of Health Care related waste and best practices

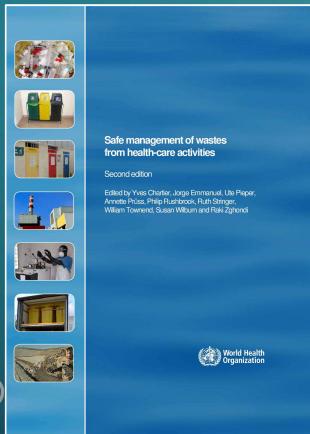
- Chapter 1-3 covers introduction, definitions, sources and characterizations of types of waste along with risks/hazards associated
- Chapters 4 and 5 cover regulatory and policy issues, as well as management planning strategies for waste
- Chapter 6 reviews Health-care waste minimization, reuse and recycling
- Chapter 7 covers waste storage, handling and transport of waste, while Chapter 8 covers treatment and disposal considerations
- Chapter 9 covers waste water and sewage treatment
- Chapter 10 economic considerations of healthcare waste management
- Chapter 11 Health and safety practices for health-care personnel and waste workers
- Chapter 12 looks at Hospital Hygiene and Infection Control
- Chapter 13 covers training and education issues
- Chapter 14 Health-care waste management in emergencies
- Chapter 15 Future considerations for healthcare waste management



# Safe Management of Wastes from Health-Care Activities

## Introduction

- Safe health-care waste management is fundamental for the provision of quality, people-centered care, protecting patient and staff safety and safeguarding the environment.
- The indiscriminate and erratic handling and disposal of waste within health-care facilities is now widely recognized as a source of avoidable infection, and is synonymous with public perception of poor standards of health care.
- The Blue Book is designed to be a source of impartial health-care information and guidance on safe waste-management practices.
- Audience for the Bluebook: medical staff, health-care facility directors, ancillary health workers, infection-control officers, waste workers, regulators, policymakers, development organizations, voluntary groups, environmental bodies, environmental health practitioners, advisers, researchers and students



# Safe Management of Wastes from Health-Care Activities



## Chapter 2: Definition and characterization of health-care waste

- The term health-care waste includes all the waste generated within health-care facilities, research centres and laboratories related to medical procedures.
- Examples of what and where the health care waste comes from, Daily HCW data-collection form (table 2.4)

# Safe Management of Wastes from Health-Care Activities

## Chapter 2 cont: Definition and characterization of health-care waste

Infectious waste:



Pharmaceutical waste:



Pathological waste:



Cytotoxic waste:



Sharps waste:



Radioactive waste:



Chemical waste:



Non-hazardous or general waste:



# HEALTHCARE WASTE SEGREGATION

- Health-care waste is often not appropriately segregated into hazardous or non-hazardous wastes
- Training and awareness of proper waste segregation can reduce costs and save resources



# Safe Management of Wastes from Health-Care Activities

## Chapter 3: Risks associated with health-care waste

- Types of hazards associated with health-care waste:
  - presence of infectious agents
  - a genotoxic or cytotoxic chemical composition
  - presence of toxic or hazardous chemicals or biologically aggressive pharmaceuticals
  - presence of radioactivity
  - presence of used sharps
- Who may be at risk:
  - medical doctors, nurses, **laboratory personnel** health-care auxiliaries and hospital maintenance personnel
  - patients in health-care facilities or receiving home care
  - visitors to health-care facilities
  - workers in support services, such as cleaners, people who work in laundries, porters
  - workers transporting waste to a treatment or disposal facility
  - workers in waste-management facilities (such as landfills or treatment plants), as well as informal recyclers (scavengers)
  - The general public



# Safe Management of Wastes from Health-Care Activities



## Chapter 4: Legislative, regulatory and policy aspects of health-care waste

- Active government intervention is usually needed to have an impact more widely across a country
- a blueprint driving decision making at a political level and allow mobilization of effort and resources to make changes
- national policy should take into account needs and situations in the country, as well as international agreements and conventions governing public health, sustainable development, the environment and safe management of hazardous waste
- Covered in later session

# Safe Management of Wastes from Health-Care Activities



## Chapter 5: Legislative, regulatory and policy aspects of health-care waste

- Healthcare waste planning at national and facility level

## Chapter 6: Health-care waste minimization, reuse and recycling

- Waste Management Hierarchy
- Minimization, safe reuse, recycling, and recovery

## Chapter 7: Segregation, storage and transport of health-care waste

- Segregation systems and hazard symbols
- Waste container specifications
- Intra-facility and off-site transport and storage



Biohazard sign for infectious  
and sharps waste



# Safe Management of Wastes from Health-Care Activities



## Chapter 8: Treatment and disposal methods

- Selection of treatment methods
- Covered in later slide

## Chapter 9: Collection and disposal of wastewater

- Characteristics of health-care wastewater
- Untreated wastewater can result in waterborne diseases and environmental concerns, and pollute drinking-water resources
- Methods of treatment

## Chapter 10: Economics of health-care waste management

- Healthcare waste management costs and cost estimation criteria
- Waste management equipment considerations, costing, cost reduction
- Pricing models for treatment providers
- Recommendations for cost reductions

## **Safe Management of Wastes from Health-Care Activities**

# **Chapter 11: Health and safety practices for healthcare personnel and waste workers**

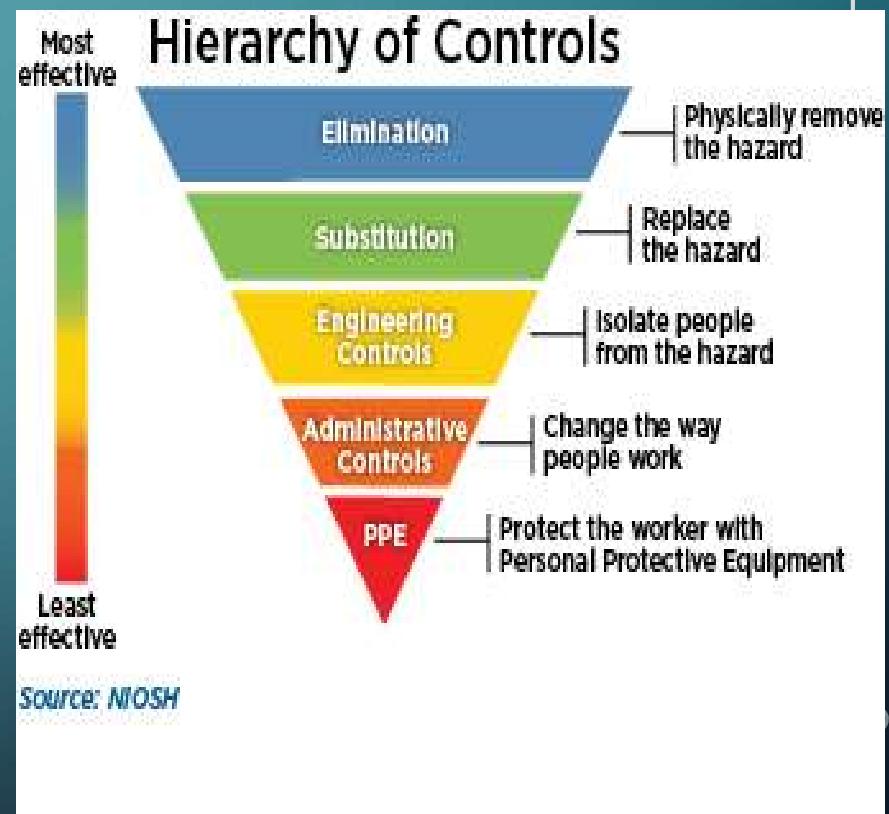


- Inform and train waste workers on the identification of hazards and recommendations for exposure prevention and control;
  - Provide Personal Protective Equipment (PPE) and training
  - Establish an occupational health programme



## Exposure prevention using the “Hierarchy of Controls”

- Elimination of hazard – complete removal of a hazard.
- Engineering controls – controls that isolate or remove a hazard.
- Administrative controls – policies to limit exposure to a hazard (e.g. universal precautions).
- Work practice controls – controls that reduce exposure to occupational hazards through the behaviour of workers.
- Personal protective equipment (PPE) – barriers and filters between the worker and the hazard.



# Safe Management of Wastes from Health-Care Activities

## **Chapter 12: Hospital hygiene and infection control**

- Sources of infection and routes of transmission
- Cleaning, sterilization and disinfection
- Characteristics of disinfectants
- Standard precautions and Handwashing protocols

## **Chapter 13: Training, education and public awareness**

- To raise awareness of the health, safety and environmental issues relating to health-care waste
- Training examples (Who, What, When, Where, and How), planning and resources

## **Chapter 14: Health-care waste management in emergencies**

- Outbreaks, natural disasters and conflicts
- Rapid assessment and emergency response (simple action plan development)



# Safe Management of Wastes from Health-Care Activities



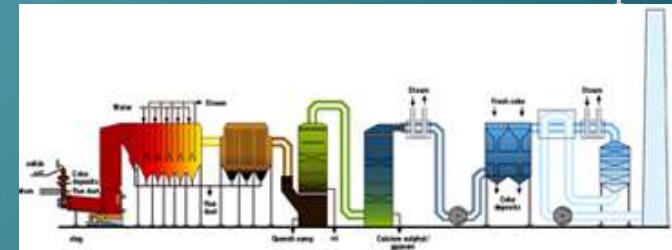
## Chapter 8 (In Depth Considerations): Treatment and disposal methods

- Selection of treatment methods
- Treatments for infectious waste
  - Thermal
  - Chemical
  - Irradiation
  - Biological
  - Mechanical
- Overall Hazardous waste treatment methods

# WASTE REMEDIATION TECHNOLOGIES AND CONSIDERATIONS

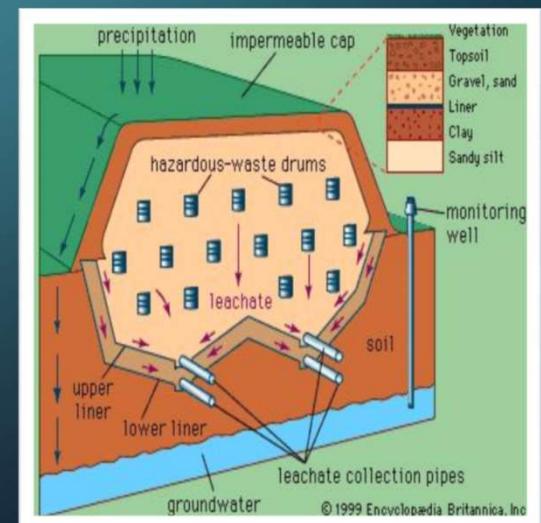
**High temperature incineration (e.g., cement and rotary kilns)**

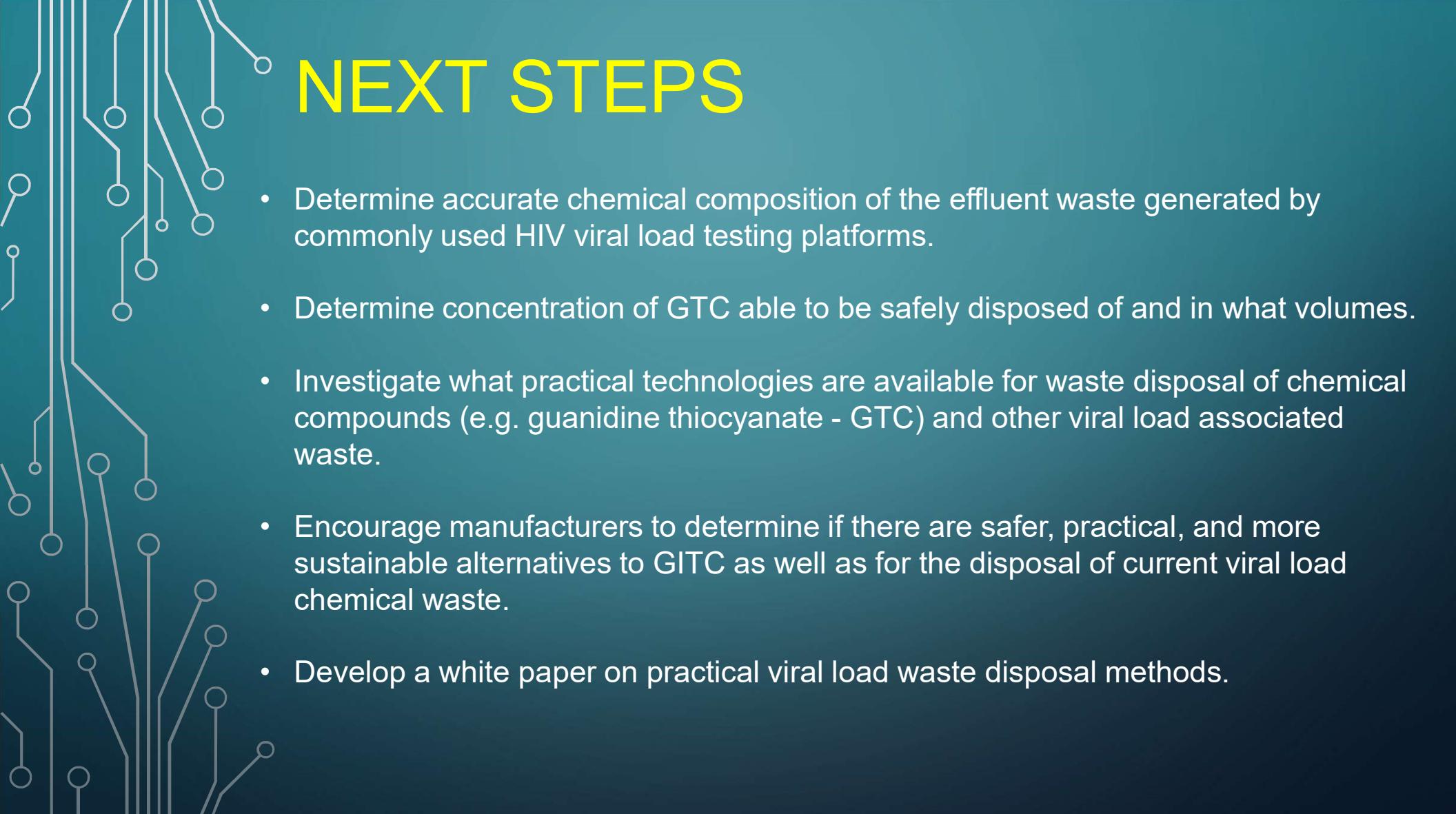
- Temperatures must reach and be held at approx. 1100° C
  - Must be monitored for emissions and equipped for chemical use
  - Can be expensive to build and maintain; can be used to generate electricity
  - Requires a certain liquid to solid waste ratio (rotary) or high-energy source to burn the waste (cement)



## Encapsulation and landfill

- Requires land, correctly erected landfill sites with barriers and monitoring probes (monitoring for at least 40 years for leakage)





## NEXT STEPS

- Determine accurate chemical composition of the effluent waste generated by commonly used HIV viral load testing platforms.
- Determine concentration of GTC able to be safely disposed of and in what volumes.
- Investigate what practical technologies are available for waste disposal of chemical compounds (e.g. guanidine thiocyanate - GTC) and other viral load associated waste.
- Encourage manufacturers to determine if there are safer, practical, and more sustainable alternatives to GITC as well as for the disposal of current viral load chemical waste.
- Develop a white paper on practical viral load waste disposal methods.

## **GENERAL GUIDING PRINCIPLES TO ENSURE SAFE WM PRACTICES**

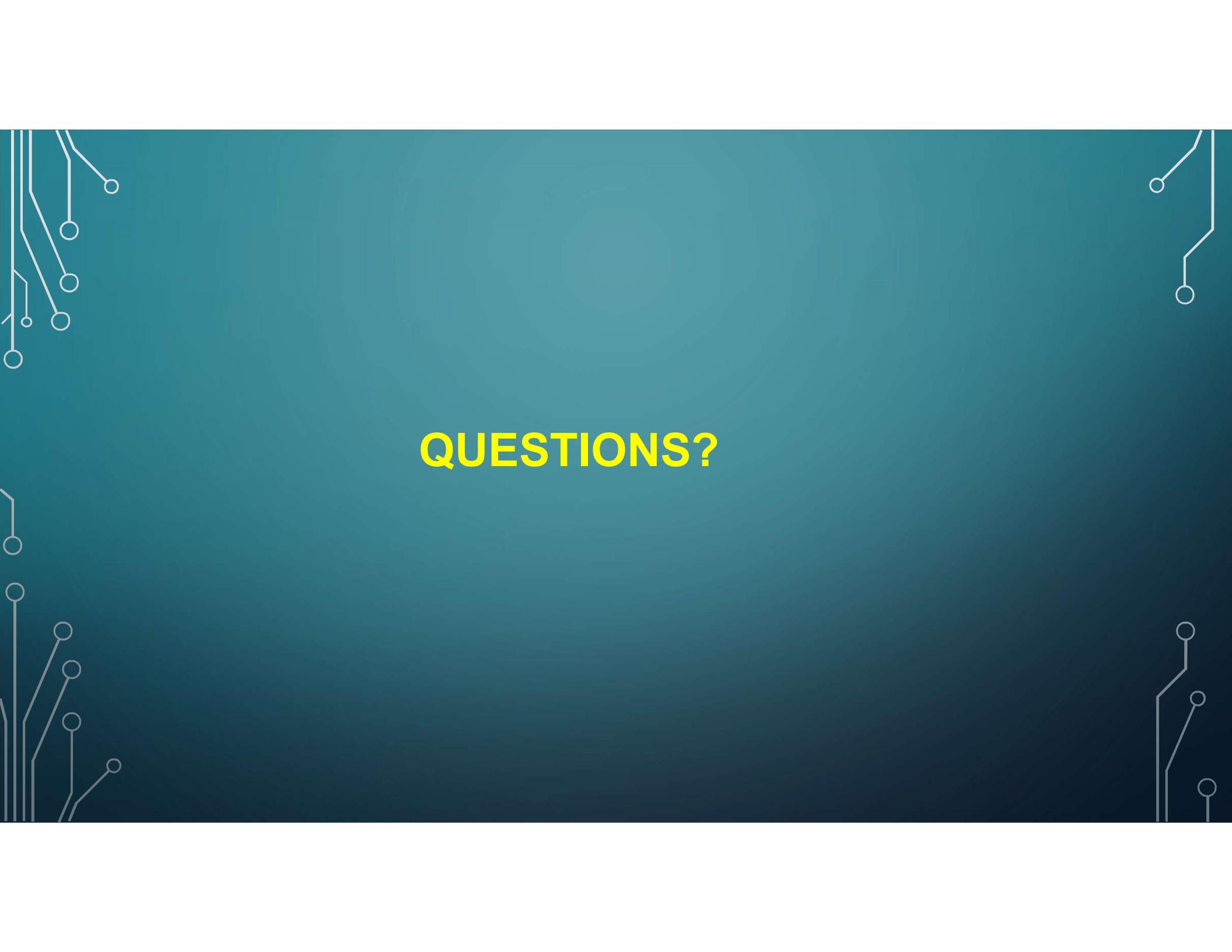
- Understand the hazards to healthcare workers such as biological, chemical, disinfectants, sharp injuries, lifting heavy loads, etc.
- Implement and enforce standard waste management practices and procedures (e.g., proper collection, segregation, transport, and disposal of waste)
- Implement exposure prevention and control plans to include dealing with spills, reporting accidents and incidents, use of effective PPE, PEP policy and procedures, immunization, etc.
- Ensure that all workers are trained on the potential hazards of waste and general biosafety practices and procedures



**Do NOT Dump  
Hazardous Materials  
Or Waste into the Sink**

## REFERENCES AND RESOURCES

- WHO publication: Safe management of wastes from health-care activities, 2014. [http://www.who.int/water\\_sanitation\\_health/publications/safe-management-of-waste-summary/en/](http://www.who.int/water_sanitation_health/publications/safe-management-of-waste-summary/en/)
- WHO publication: Safe management of wastes from health-care activities: A summary, 2017. <http://apps.who.int/iris/bitstream/handle/10665/259491/WHO-FWC-WSH-17.05-eng.pdf;jsessionid=91A3806F2AF2049CCD058A09A062C2EA?sequence=1>
- Resources for LMIC waste issues:
  - <https://www.healthcare-waste.org/resources/introduction/>
  - <https://www.healthcare-waste.org/resources/documents/>



**QUESTIONS?**