APRIL 2026 WASTE MANAGEMENT SESSION

FRAMEWORK FOR THE SELECTION, IMPLEMENTATION, AND FINANCING OF LABORATORY WASTE MANAGEMENT

In this session, we will be discussing the guidance on waste management and the critical necessity for effective waste management to ensure public health, environmental safety, and regulatory compliance.

PRESENTERS

Anafi Mataka
Head Of Division, ASLM

Dr Collins Otieno
Portfolio Lead, ASLM

Edward Krisiunas
President, WNWN International

Viktor Hristov
WNWN International
Senior HCWM Consultant

zoom :https://us02web.zoom.us/j/81282115205

JOIN US ON 14 APRIL 2026, 16:00 TO 17:00 EAST AFRICA TIME

Lab CoP

ASLM

Welcome!!

Viktor Hristov – WNWN International, Macedonia
Ed Krisiunas - WNWN International, USA

Objectives

Overview of the following documents being released today

Practical Considerations for Managing GTC Waste
Framework for the Management and Treatment of Laboratory Waste

https://aslm.org/resource/practical-considerations-for-managing-laboratory-guanidinium-thiocyanate-gtc-containing-waste-from-hiv-viral-load-and-early-infant-diagnosis-platforms/

Partial Contents:

Waste Disposal Option Matrix

Waste Disposal Options

Work Instructions

GTC Waste Precipitation Helper

https://aslm.org/resource/practical-considerations-for-managing-laboratory-guanidinium-thiocyanate-gtc-containing-waste-from-hiv-viral-load-and-early-infant-diagnosis-platforms/

IT BEGAN WITH GTC...

Guanidine Thiocyanate (GTC) Waste Management

- The initiative began with the recognition of the challenges posed by GTC waste, a hazardous chemical commonly used in HIV Viral Load (VL) and Early Infant Diagnosis (EID) testing.
- GTC waste, if not managed properly, can lead to significant environmental and public health risks.

THE TEAM…..

ASLM

CDC

WNWN International, Inc.

Laboratory Viral Load (VL) and Early Infant Diagnosis (EID)
Waste Management Country Assistance
Project Diagram

Eswatini **Ethiopia** **Kenya** **Malawi** **Zimbabwe** **Mozambique** **Nigeria** **Uganda** **Zambia**

✓ **TASK 1: Assess country guidelines/policies/regulations on Healthcare waste management**
Primary focus : Determination on inclusion of VL/EID waste management in national plans

✓ **TASK 2: Identify VL locations/platforms/Quantities of VL waste through collaboration with country contacts**

✓ **TASK 3: SWOT analysis of VL management situations in country**

✓ **TASK 4: Develop VL and EID Waste Management Guidance Document**

Secondary focus: Clinical Lab Waste Management Guidance Document

TASK 5: Conduct Training on VL and EID Waste Disposal Options
Onsite/Remote

MAIN OBJECTIVE: PROVIDE EVIDENCED BASED PRACTICES FOR WASTE MANAGEMENT FROM VL/ EID PLATFORMS

Treatment/Disposal Methods

- Transfer to plastic bottle (volume TBD determined) and incinerate locally – small volumes
- Cartridge waste – Incinerate/Other treatment technologies
- Mix with dry waste (saw dust) and treat / incinerate locally – larger volumes
- Mix with ground charcoal and incinerate (To cement kiln)
- Transport liquid to cement kiln for disposal (20 L maximum per container re: Lafarge plants
- Mix with cement / crushed medication vials – burial location or use TBD
- Transboundary movement to country with treatment and disposal methods

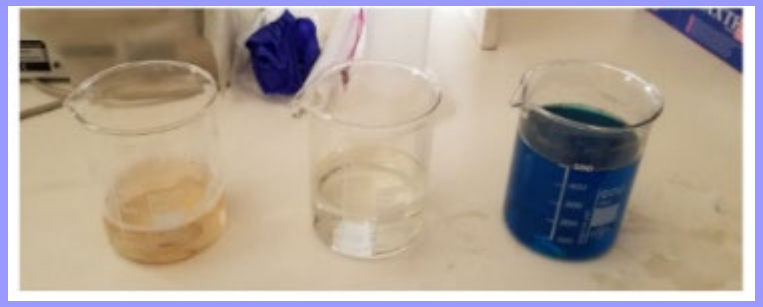
- Precipitation method
- Liquid injection into incinerators
- Bioremediation (University of Cape Town)

Management of viral load waste streams Zambia January 2020

Lake Bangweulu

GTC Precipitation Protocol - 2020

(Novel method developed in the frame of this project)



- Resulting cuprous thiocyanate precipitate can be mixed with
- saw dust or charcoal dust or absorbent waste and incinerated
- Mixed with cement
- Mixed with paint (anti fouling agent)

Countries Trained in 2022


Team Ethiopia


Team Malawi

Team Nigeria (Virtual)


Team Zimbabwe


Team Zambia

Team Uganda


Team Kenya

Also Eswatini and Mozambique (virtually)

Cape Town, South Africa
Lasec Group
May 2024

Regional Training I

Angola, Botswana, Eswatini, Ghana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe

Addis Ababa, Ethiopia
EPHI
May 2024

Regional Training II

Ethiopia, Kenya, Liberia, Nigeria, Rwanda, Sierra Leone , Tanzania, Uganda

Accra , Ghana
June 2024
Noguchi Research Center
Francophone Countries

Regional Training III

Benin, Burkina Faso, Burundi, Cote d’Ivoire, DRC, Mali, Senegal

26 countries

+ South Sudan

ASLM / PEPFAR / LABCOP

Laboratory Viral Load and Early Infant Diagnosis Waste Management Country Assistance

CON/CONS/2020/010

Period of performance 2020-2025

- Number of Countries initially: 9 (Eswatini, Ethiopia, Kenya, Malawi, Mozambique, Nigeria, Uganda, Zambia, and Zimbabwe)
- Estimated Online meetings: ASLM 340; US CDC 260; Countries 250.
- Total # of laboratories from the country Networks: 112 HIV VL; 780 POC
- Countries visited: 10, more than 70 meetings with stakeholders
- Online ASLM sessions: 4, average 600 attendees per session
- Attendance on more than 150 online sessions
- 3 regional GTC training workshops, approx. 90 attendees from 27 Countries

Country ongoing activities – GTC liquid waste mgt as of April 2026

Country	SOP/Policy	Sawdust/ Incineration	Charcoal dust/ Incineration	Precipitation	Incineration	H2O2/UV treatment	Other/No activity/On Hold
Cote d' Ivoire		✓		✓(Pilot)			
DRC	✓			✓			
Eswatini	✓			✓			✓
Ethiopia	✓			✓			
Lesotho	✓			✓			✓ TBM
Kenya	Draft						
Malawi					Cartridges		✓
Mozambique							✓
Nigeria	✓				✓/Cartridges		
South Sudan	✓				Cartridges		
South Africa	✓				✓		
Tanzania							Assessment stage
Uganda	✓				Cartridges	✓	
Zambia	✓	✓	✓	✓			
Zimbabwe				✓	✓		

RMG Cote d’Ivoire
4 November 2024

Charcoal dust mixed with liquid GTC waste and incinerated. Lab technologists operate the incinerator

Lusaka, Zambia

https://www.chaz.org.zm/

March 2026 – Eswatini 1,400 Liters GTC waste in storage
Precipitation method initially used for treatment

ETHIOPIAN PUBLIC HEALTH INSTITRUTE NATIONAL LABORATORIES CAPACITY BUILDING BIOSAFETY BIOSECURITY DIVISION

STANDARD OPERATING PROCEDURE FOR GTC WASTE MANAGEMENT FOR HIV VL/EID LABORATORY VIA PRECIPITATION METHOD

Compiled By:	**Signature:**
Reviewed by:	**Signature:**
Approved By:	**Signature:**
Issues Date:	**Version No. 1.0**
Document No:	**Copy No. _____**
Date of discontinued/ obsolete:	**Name: _____ Sign: _____**

République Démocratique du Congo
Ministère de santé Publique

SOP

Traitement des déchets VL/EID contenant le Thiocyanate de Guanidine

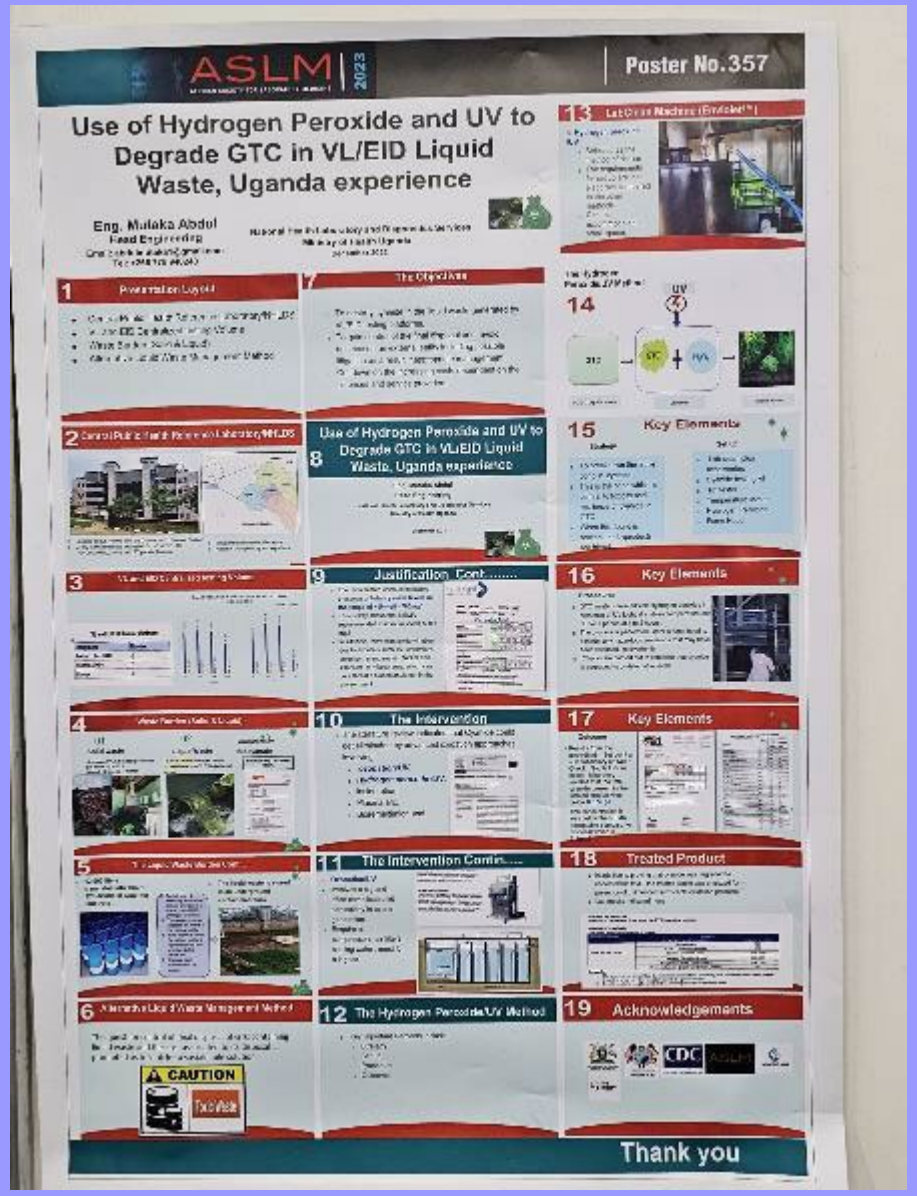
Décembre 2025

Lesotho
2,400 liters

1,000 liter IBC
Transboundary
Movement

Fluid injection into incinerator from VL labs in the region

Port Harcourt, Nigeria



Uganda CPHL
Future liquid waste storage facility to be built

Bioremediation

Guanidine thiocyanate degradation update

Sarah Fernandes (University of Cape Town)

Viktor Hristov and Ed Krisiunas

In cooperation with BioPrevail Project - Ongoing since 2025

Analysis of the samples

Molecular PCR Laboratories

ekrisiunas@gmail.com
viktorhr@t.mk

Colleagues across Africa to communicate with and share your experiences on GTC waste management

“After climbing a great hill, one only finds that there are many more hills to climb.”

Nelson Mandela

https://aslm.org/resource/framework-for-the-selection-implementation-and-financing-of-strategies-for-the-management-and-treatment-of-laboratory-waste/

Some thoughts from the Authors:

Laboratories manage large numbers of potentially dangerous samples...on purpose

Laboratories grow microorganisms in large quantities ...on purpose

Laboratories use hazardous chemicals... on purpose

With so many potentially dangerous activities being done on purpose, we must ensure safe work environment and effective laboratory waste management.

Ensuring standards leave no room for improvisation or neglecting !!!
HOWEVER

Staggering volumes of lab waste due to modern lab technology and COVID / HIV / TB / Malaria Testing /AMR etc.

Engineering a sustainable future for point-of-care diagnostics and single-use microfluidic devices

Alfredo Edoardo Ongaro, [a] Zibusiso Ndlovu, [b] Elodie Sollier, [c] Collins Otieno, [d] Pascale Ondoa, [d] Alice Street [e] and Maïwenn Kersaudy-Kerhoas [*fg]

Cover: Val Myburgh, South Africa; Lab Chip, 2022, 22, 3122

And we were not the only ones!!!

And it is not only GTC waste!

Ref link: [Engineering a sustainable future for point-of-care diagnostics and single-use microfluidic devices - Lab on a Chip (RSC Publishing)]

Tools for change: Quantifying and Understanding Diagnostic Plastic Waste

Alice Street

Maïwenn Kersaudy-Kerhoas

ASLM Waste Sub-CoP session
24th March 2026

Photograph: Edward Krisiunas / ASLM

In total 3 face-to-face and 30 virtual weekly meetings and consultations (in a period of 6 months)

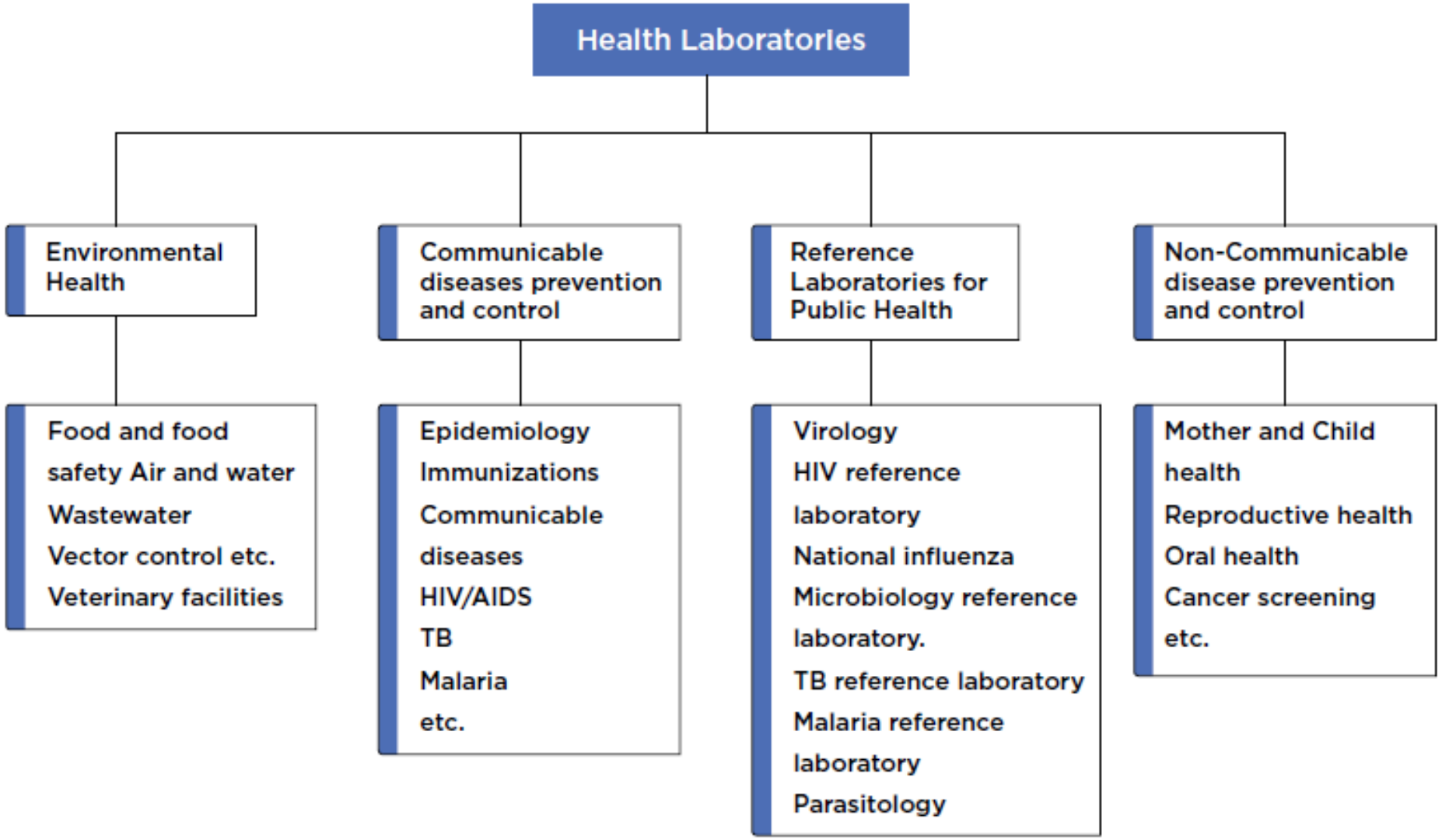
Guiding Principles For Laboratory Waste Management
Regulatory Frameworks
Laboratory Waste Management Responsibilities
Identification And Classification of Laboratory Waste
Laboratory Waste Treatment
Validation of waste treatment technologies
Strengthening National Laboratory Waste Management Capacities
Financing of Sustainable Healthcare Waste Management
Investment Costs
Operating Costs
Reporting And Monitoring
Health And Safety
Achieving Laboratory Sustainability

https://aslm.org/resource/framework-for-the-selection-implementation-and-financing-of-strategies-for-the-management-and-treatment-of-laboratory-waste/

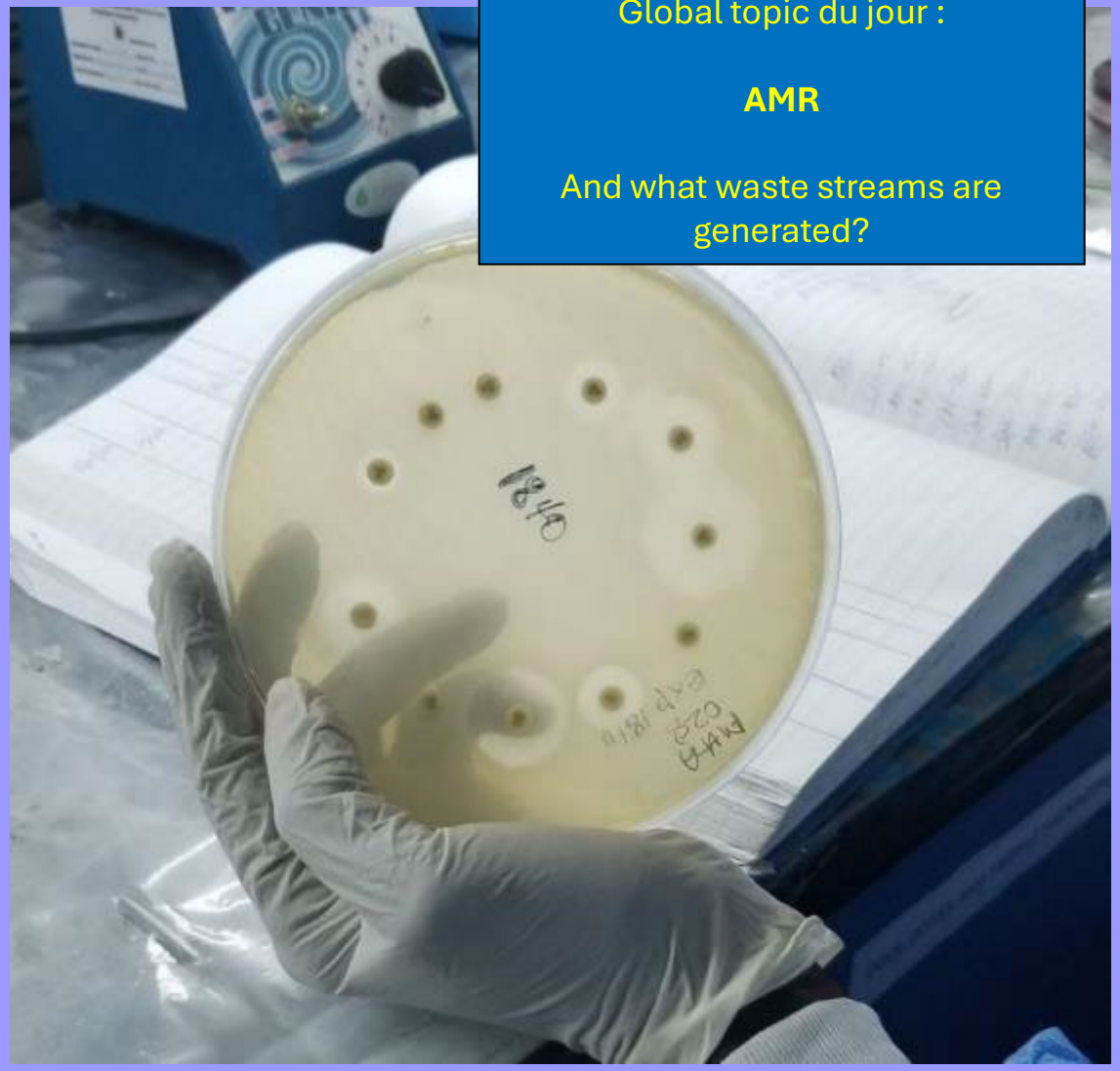
Technical Working Group on Lab Waste Management Guidance – 2024 (Johannesburg and Addis Ababa)

Stakeholder Group on Lab Waste Guidance, Accra, Ghana August 2024

Figure 2 Diagram of healthcare laboratories



The purpose was to address all healthcare waste streams



Global topic du jour :

AMR

And what waste streams are generated?

Examples of UN four-digit numbers used to identify dangerous goods for transport:

Category A substances include

UN2814, Infectious substances affecting humans

UN2900, Infectious substances affecting animals

UN3549 Regulated medical waste not otherwise specified

(Category A substances produced from the medical treatment of humans or animals)

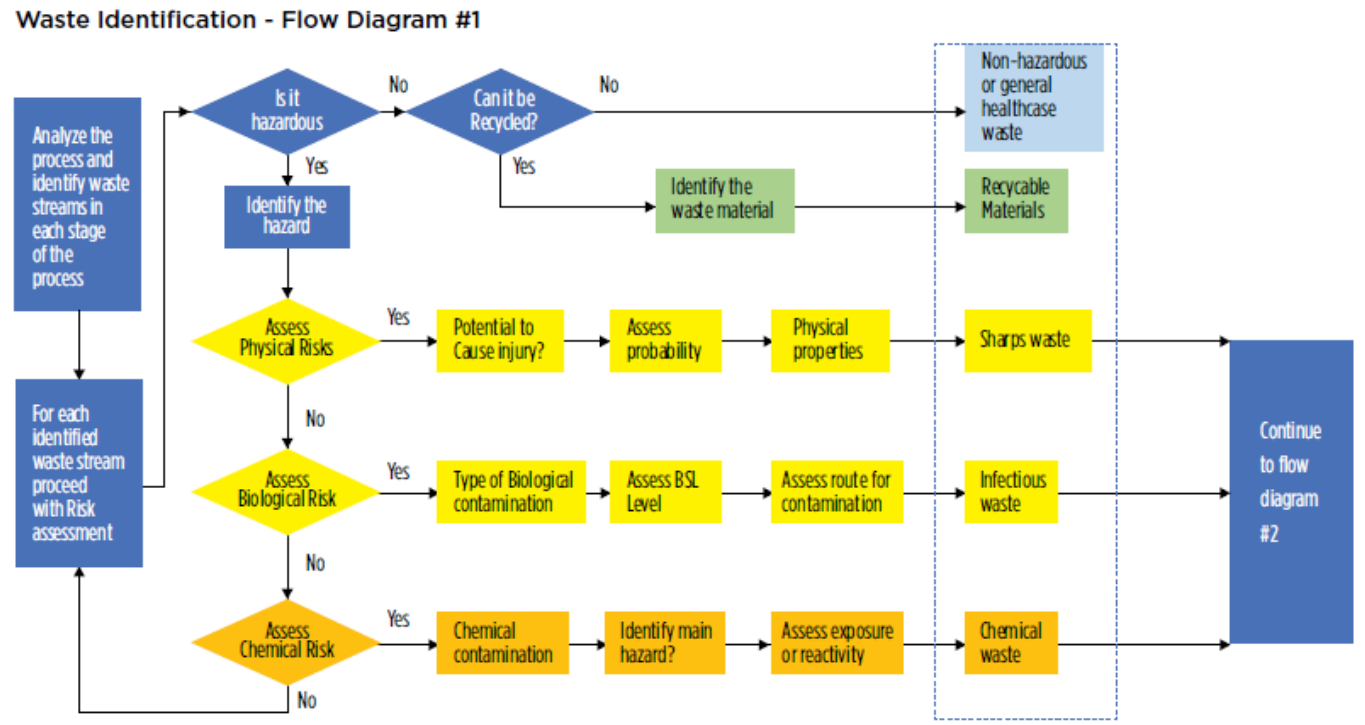
Category B substances include:

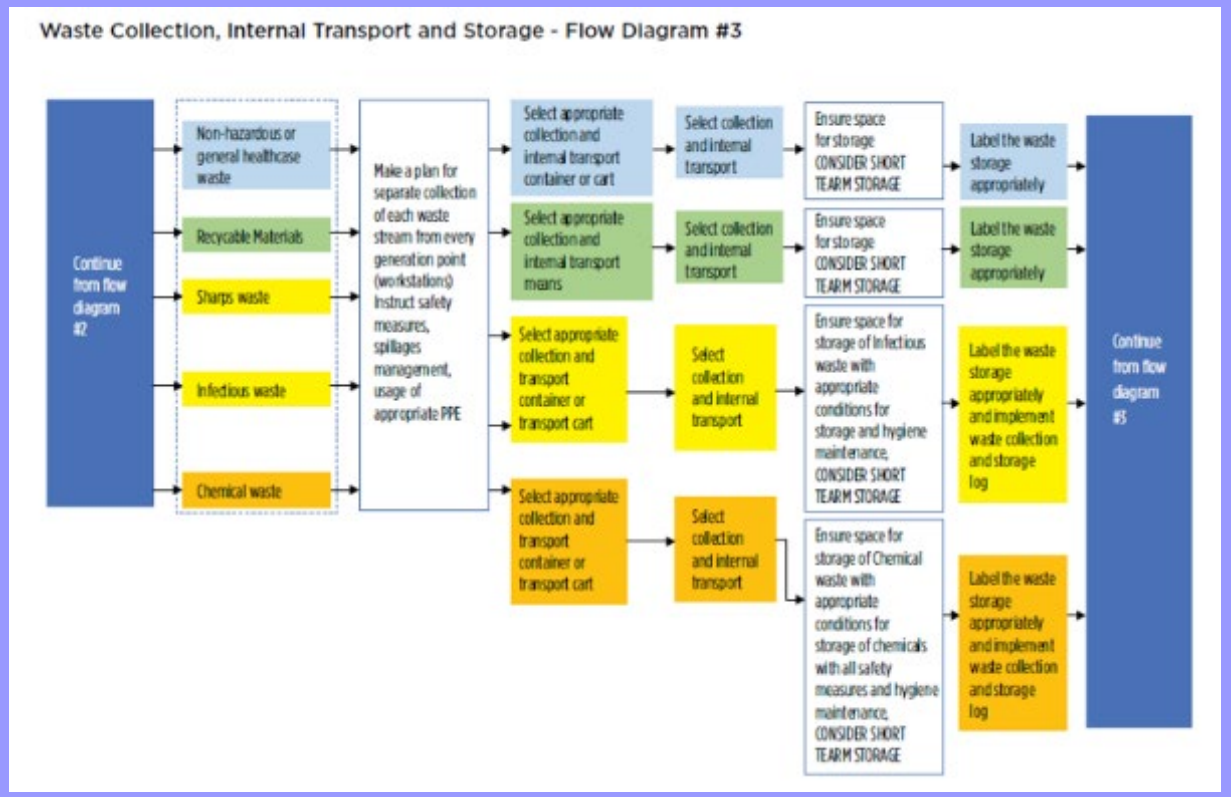
- UN3733, Biological substances, Category B
- UN3291, REGULATED MEDICAL WASTE, (N.O.S.)*, (Category B substances produced from the medical treatment of humans or animals)4

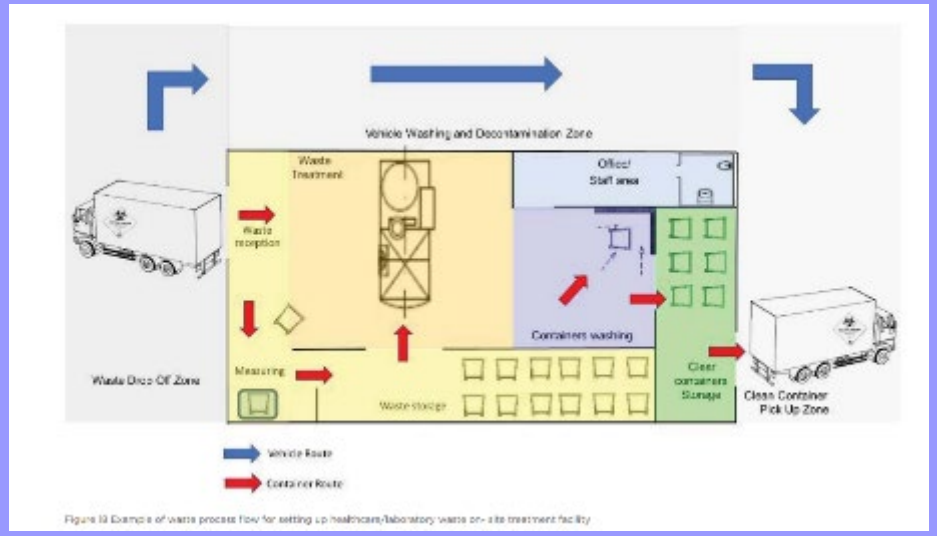
*N.O.S. – Not Otherwise Specified

An example of a waste identification and classification process, based on the evaluation and exclusion of hazardous properties, applicable to healthcare waste and only for descriptive purposes only, is shown in Figure 5 below.

Figure 5 Waste Identification - Flow Diagram #1




Waste Collection, Internal Transport and Storage - Flow Diagram #3
Continue from flow diagram #2
Non-hazardous or general healthcare waste
Recycable Materials
Sharps waste
Infectious waste
Chemical waste
Make a plan for separate collection of each waste stream from every generation point (workstation) Instruct safety measures, spillages management, usage of appropriate PPE
Select appropriate collection and internal transport container or cart
Select appropriate collection and internal transport means
Select appropriate collection and transport container or transport cart
Select appropriate collection and transport container or transport cart
Select collection and internal transport
Select collection and internal transport
Select collection and internal transport
Select collection and internal transport
Ensure space for storage CONSIDER SHORT TEARM STORAGE
Ensure space for storage CONSIDER SHORT TEARM STORAGE
Ensure space for storage of Infectious waste with appropriate conditions for storage and hygiene maintenance, CONSIDER SHORT TEARM STORAGE
Ensure space for storage of Chemical waste with appropriate conditions for storage of chemicals with all safety measures and hygiene maintenance, CONSIDER SHORT TEARM STORAGE
Label the waste storage appropriately
Label the waste storage appropriately
Label the waste storage appropriately and implement waste collection and storage log
Label the waste storage appropriately and implement waste collection and storage log
Continue from flow diagram #5


Vehicle Washing and Decontamination Zone
Waste Treatment
Office/ Staff area
Waste reception
Containers washing
Waste Drop Off Zone
Measuring
Waste storage
Clean containers Storage
Clean Container Pick Up Zone
Vehicle Route
Container Route


Most Preferred
Least Preferred
Prevention
Re-use
Recycling
Recovery
Disposal


UN Code for Fiberboard Box (4G) and Variable innercontainer material and configuration (v)
Solid or Inner Packagings
State/Country authorizing mark
4GV/X13/S/08/USA/+AQ2121
United Nations Packaging Symbol
Packaging Group tested and max. grossmass (kg)
Last two digits of the year of manufacture
Manufacturer certifying package
CAUTION
CONTAMINATED MATERIALS

Figure 29 Bondtech static autoclave

Figure 30 Ecodas hybrid autoclave (integrated shredder)

Figure 31 Tesalys autoclave (integrated shredder)

Figure 32 Ecosteryl microwave technology

Alternative technologies (tissue digester and solvent recovery / recycling)

Figure 38 Tissue digestor (Envirogest)

Tissue digestors are now a standard tool for the management of a wide range of anatomical waste such as organs/ soft tissue, placentas, and animals used in research. Potassium or sodium hydroxide are used to dissolve tissue (Figure 38).

It would be prudent to consider implementing solvent recovery and recycling systems in histology laboratories that utilize spent solvents such as alcohols, xylene and formaldehyde. (Figure 39)

Wheeled solvent recovery

Formalin recovery

Figure 39 Solvent recovery / recycling systems CBG

9. Financing of Sustainable Healthcare Waste Management

The economic implications of developing and maintaining adequate waste treatment and disposal infrastructure present significant challenges, especially for LMICs. This section provides a comprehensive guide to the economic aspects of healthcare waste treatment and disposal. It addresses the financial implications of waste management, including the costs and investments required for the available funding mechanisms, and the long-term economic benefits and sustainability of robust waste management systems. The financing of healthcare waste management operations may vary depending on the country, region, and healthcare system in place. To establish a safe, effective, and sustainable healthcare waste management system, it is necessary to develop a sustainable plan for health care waste management. The plan can be developed at the national, regional, municipal, or institutional level, if it is consistent national legislation and/or international regulations and best practices. The healthcare waste management sustainability plan along with its level of implementation will further identify investments, operations, and cost implications to inform resource mobilization strategies.

9.1 - Investment Costs

The investment costs for healthcare waste management can vary significantly depending on numerous factors such as the size of the healthcare facility, the volume and type of waste generated, regulatory requirements, technological alternatives, and geographical location (Figure 48).

Initial Capital Investment

The establishment of healthcare waste management infrastructure requires a substantial initial capital investment. The construction of advanced incineration plants, autoclaves, engineered landfills, and waste-to-energy facilities requires a significant financial investment. For instance, the cost of constructing a modern incinerator that meets international standards[24] including pollution control technologies, can be expensive depending on capacity and technological specifications.

Technological Investments

Investing in state-of-the-art technology is crucial for ensuring the effectiveness and efficiency of waste treatment facilities. Technologies such as autoclaving, microwaving, and chemical disinfection systems, while less environmentally damaging, also require significant financial investment. The implementation of these technologies requires the acquisition of specialized equipment and infrastructure modifications to ensure the effective management of healthcare waste treatment.

Operational Costs

The financial burden of healthcare waste management is compounded by the costs associated with its operation. Such costs include those associated with fuel, maintenance, labour, and compliance with environmental and safety regulations. For example, autoclaves and other non-burn technologies, despite their environmental benefits, still require significant operational funding. Furthermore, regular monitoring, maintenance, and compliance with safety and environmental regulations contribute to the overall financial burden.

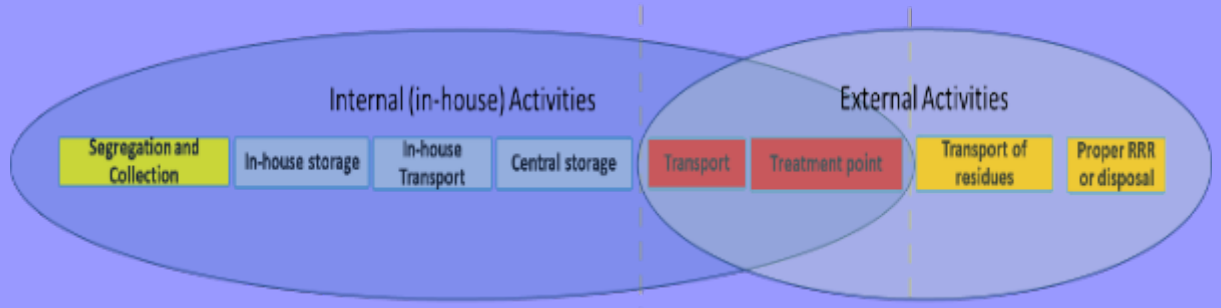
Training and Capacity Building

It is similarly imperative to direct investment towards the training and capacity building of personnel involved in waste management. This includes healthcare workers, waste management personnel, and regulatory bodies. The implementation of efficacious training programmes guarantees the appropriate segregation, management, and disposal of waste, thereby reducing the risk of contamination, and enhancing overall efficiency. The costs associated with these training programs, while substantial, are necessary for the sustainable operation of waste management systems.

Infrastructure Maintenance

It is of paramount importance to implement a long-term infrastructure maintenance programme to guarantee the durability

Investment costs considerations



Materials for Segregation and collection of waste - bins, bags, sharps containers, labels, posters,

In-house transport of waste - trolleys, carts

Store waste on site –special facility, Weighting scale, waste containers or bins –

Emergency response - spill kits, fire safety equipment

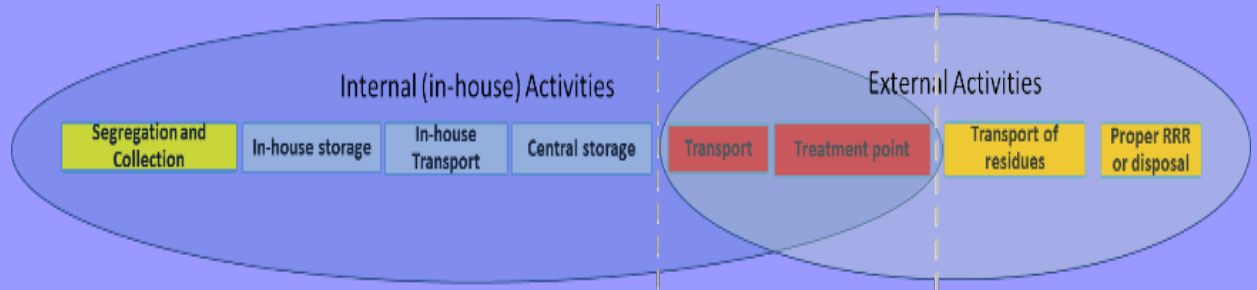
Vehicles for transport of waste to treatment point

Waste treatment equipment- autoclaves and disinfection units, solvent recycling, chemical neutralization, tissue digesters etc.

Waste treatment Facility – Building, Water, power and Fuel supply, Emissions control, Licenses and Permits, etc.

Vehicles for transport of treatment residues to disposal or RRR facility

Operational costs considerations



Manual labor for waste management workers

Materials for segregation and collection of waste - bins, bags, sharps containers

Service and hygiene maintenance of In-house transport capacities

Hygiene maintenance of storage facilities

Provision of Personal Protective Equipment – Identified according the workplace risks, but as minimum appropriate ace masks or respirators, appropriate gloves, gowns, safety boots etc.

Manual labor for waste workers Carriers and Treatment plant operators

Depreciation cost for operation of equipment and vehicles

Fuel and maintenance for vehicles for transport of waste to treatment point

Waste treatment operations – Fuel, Electricity, Water, process validation,

Process qualification, validation, monitoring and mitigations

Independent inspections and validation

Manual labor of waste carriers

Costs for Vehicles for transport of treatment residues to disposal or RRR facility

Gate fee for safe and controlled disposal

Call to action Visible (Biosafety, Biosecurity, Public Health)

- Visible waste

- Invisible waste

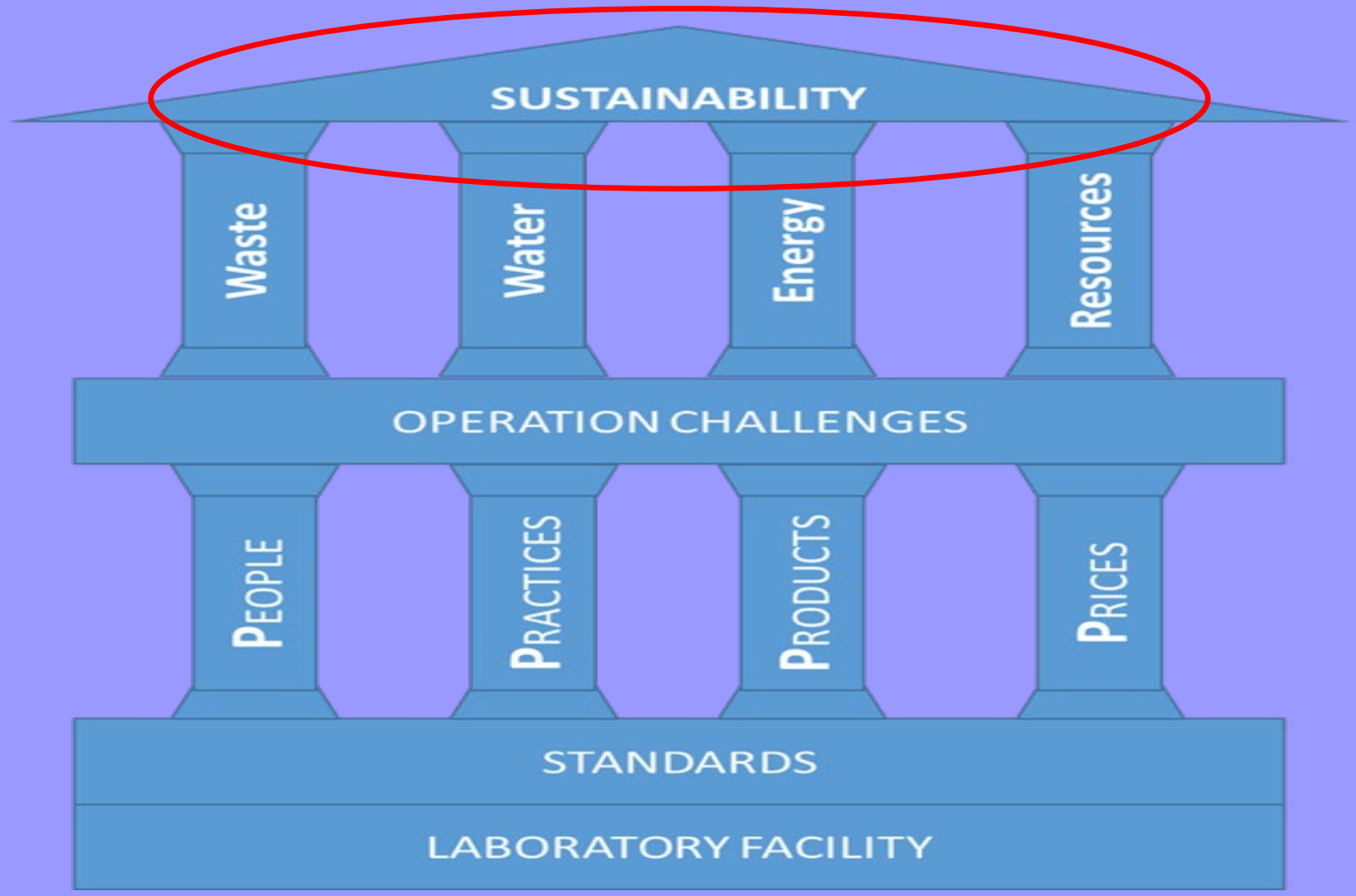
Call to action Visible (Biosafety Biosecurity, Public Health)

- Visible waste

- Invisible waste

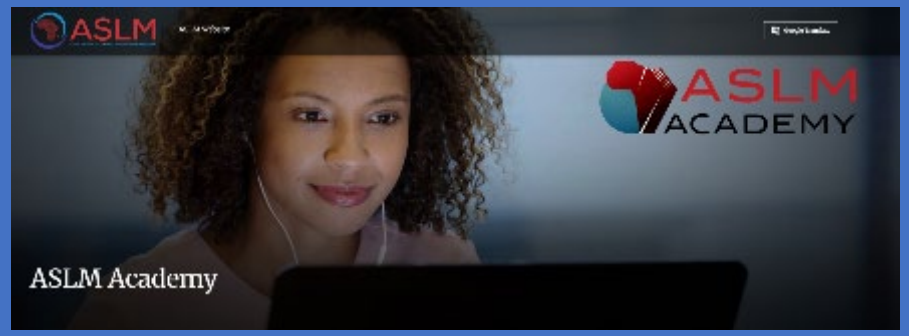
“If we close our eyes to facts, we will learn through accidents.”

African Proverb


SUSTAINABILITY
Waste
Water
Energy
Resources
OPERATION CHALLENGES
PEOPLE
PRACTICES
PRODUCTS
PRICES
STANDARDS
LABORATORY FACILITY

Tools and references at your disposal today:

https://aslm.org/resource/waste-cost-assessment-framework-wcfa-v2-0-strategic-web-based-tool-for-laboratory-waste-management/



https://aslm.org/academy/aslm-academy/

Contact us for any waste Management questions

ekrisiunas@gmail.com
viktorhr@t.mk

Call to Action
Holistic approach to
Laboratory Waste Management

Solutions and experiences exist
and are expanding

Think cradle to cradle…Not cradle to grave

Awareness Advocacy Financing Partnership

1986

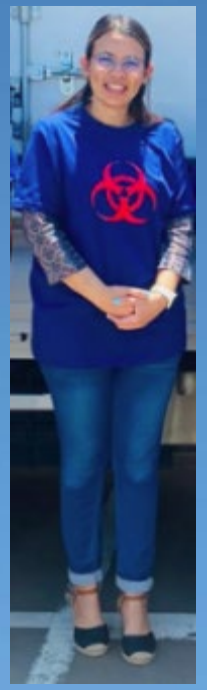
2026





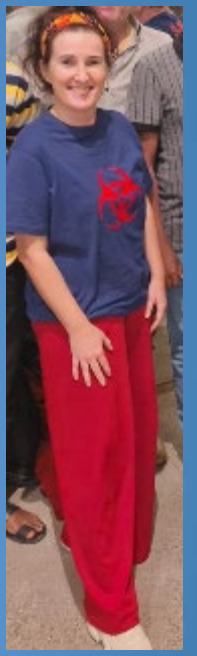













Celebrating Public Health
Eric J. Rubin, M.D., Ph.D.
N Engl J Med 391:6 October 24, 2024

" As Paul Farmer (Partners In Health) once put in a commencement address at Northwestern University, "With rare exception, all your important achievements on this planet will come from working with others – or, in a word, partnership."

Thank you / Asante / Merci / Obrigado to ASLM…CDC…laboratory colleagues across Africa for the journey…the comradery… the friendships we will never forget!