Chemicals and Waste Management Beyond 2020 Series

COMMUNITY OF PRACTICE

NATURE BASED SOLUTIONS AND CLIMATE ACTION

Session 2

Sound Management of Chemicals and Waste: Greening Health Care Waste Management

24 March 2021, 09:00 - 10:30 am EDT

Webinar organized by CoP Environment

TODAY'S SPEAKERS

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Chemicals and Waste Management beyond 2020

Sound Management of Chemicals and Waste
Greening Health Care Waste Management

Moderated by: Mr Etienne Gonin,
Programme Analyst, Montreal
Protocol and Chemicals Unit, UNDP

Healthcare Waste Management (HCWM) and SAICM

- Health : a central dimension of the SAICM process

- **Interconnection of Health and Environment** (Example in Africa: Ministerial process of Libreville)

- Health care:
  - Uses instruments with **hazardous chemicals** (Mercury)
  - Improper treatment of waste is source of chemical pollutants (uPOPs)

- Interlinkages with the **Multilateral Environment Agreements' implementation** (Stockholm and Minamata Conventions)

- Relevance **occupational health and safety** for health care workers

- Chemicals of concern in the health sector - new document by UNDP and Health Care Without Harm

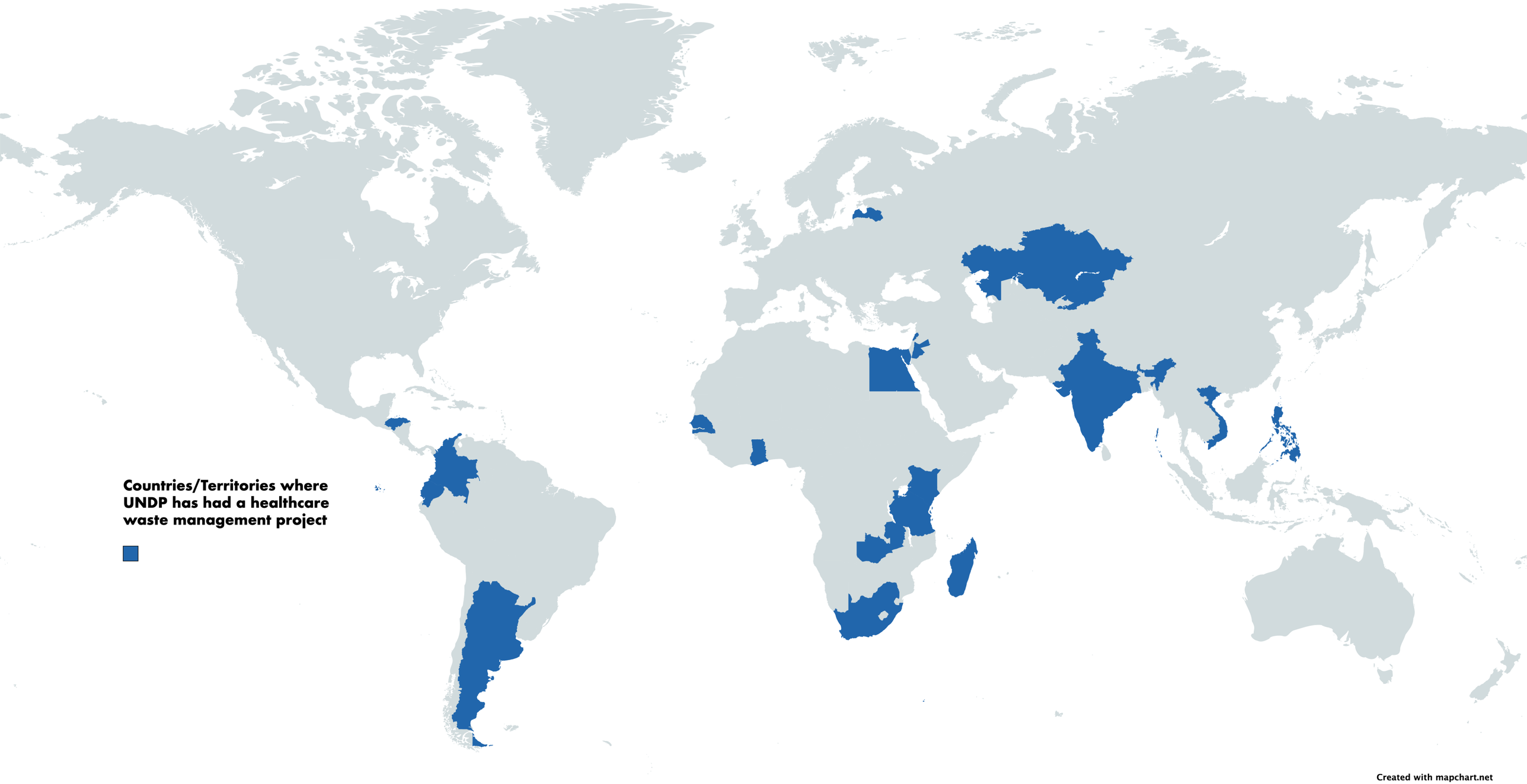
- Regularly cited a one of the **top national priorities** in assessments by developing countries

UNDP’s approach on HCWM projects

- **Partnerships:**
  - Health Care Without Harm and WHO
  - Health, Environment and Development partners (Informal streamlining task force on COVID-19 and HCWM)
  - Multiple donors (GEF, GFTAM, bilaterals), multiple teams within UNDP

- **Impact:**
  - Looking at systemic change, linking technology, policy and capacity building
  - Linking to policy and localized SDGs
  - Measuring results and sustainability
  - Analyse financial limitations to funding of HCWM

- **Innovation:**
  - Supporting new technology solutions (adapted design for autoclaves)
  - Engagement of the private sector (PPPs)
  - Sustainable procurement (SPHS, SHiPP project)
  - Response to increased waste in pandemics / epidemics (COVID-19, Ebola)
  - Exploring circular economy approaches where it makes sense


Countries/Territories where UNDP has had a healthcare waste management project
Created with mapchart.net

UNDP HCWM GEF -funded PROJECTS

Country	Project Title	Grant and Co-financing	Status
Regional Africa: Ghana, Tanzania, Madagascar, Zambia	Reducing UPOPs and Mercury Releases from the Health Sector in Africa (Ghana, Madagascar, Tanzania and Zambia)	6,453,195 & 28,936,164	Completed (2020)
Kenya	Sound Chemicals Management Mainstreaming and UPOPs reduction in Kenya	4,515,000 & 21,008,803	Ongoing
Jordan	Reduction and Elimination of POPs and Other Chemical Releases through Implementation of Environmentally Sound Management of E-Waste, Healthcare Waste and Priority U-POPs Release Sources Associated with General Waste Management Activities	5,090,000 & 64,892,008	Ongoing
Egypt	Protect Human Health and the Environment from Unintentional Releases of POPs Originating from Incineration and Open Burning of Health Care- and Electronic-waste	4,100,000 & 17,568,000	Ongoing
Colombia	Reducing UPOPs and Mercury Releases from Healthcare Waste Management, e-Waste Treatment, Scrap Processing and Biomass Burning	5,800,000 & 32,915,018	Ongoing

UNDP HCWM GEF -funded PROJECTS - Cont'd

Country	Project Title	Grant and Co-financing	Status
Honduras	Environmentally Sound Management of Products and Wastes Containing POPs and Risks Associated with Their Final Disposal	3,460,000 & 26,600,325	Ongoing
Ecuador	National Program for the Environmental Sound Management and Live Cycle Management of Chemical Substances	8,490,000 & 40,571,428	Ongoing
Maldives	Eliminating POPs through Sound Management of Chemicals	3,675,000 & 59,401,077	Ongoing
Kazakhstan	NIP Update, Integration of POPs into National Planning and Promoting Sound Healthcare Waste Management in Kazakhstan	3,400,000 & 35,012,758	Completed (2018)
Kyrgyzstan	Protect Human Health and the Environment from Unintentional Releases of POPs and Mercury from the Unsound Disposal of Healthcare Waste in Kyrgyzstan	1,425,000 & 7,032,109	Completed (2018)
Global: Lebanon, Senegal, Philippines, Argentina, Latvia, India, Vietnam, Tanzania and South Africa	Demonstrating and Promoting Best Techniques and Practices for Reducing Health-Care Waste to Avoid Environmental Releases of Dioxins and Mercury	10,326,455 & 12,970,494	Completed (2018)

GREENHEALTHCAREWASTE.ORG

A knowledge exchange platform for healthcare waste management related project and resources.

+600 DOCUMENTS
+70 COUNTRIES
+20 PROJECTS
+12 LANGUAGES

HCWM PROJECTS

Detailed overviews of GEF-financed projects with HCWM components, including key resources, links and contacts.

Other GEF -financed HCWM Projects

Country	Project Title	Grant and Co-financing	Implementing Agency	Status
Regional Africa: Ethiopia, Gabon, Kenya, Madagascar, Mali, Senegal, Tanzania, Zambia, Zimbabwe	Integrated Health and Environment Observatories and Legal and Institutional Strengthening for the Sound Management of Chemicals in Africa (African ChemObs)	10,500,000 & 20,332,000	UNEP	Ongoing
Regional Mediterranean: Albania, Algeria, Bosnia Herzegovina, Egypt, Lebanon, Libya, Montenegro, Morocco, Tunisia	Reducing Pollution from Harmful Chemicals and Wastes in Mediterranean Hot Spots and Measuring Progress to Impacts	14,250,000 & 53,146,727	UNEP	Ongoing
Regional Africa: Botswana, Mozambique, Namibia, South Africa, Swaziland, Zambia, Zimbabwe, Gambia, Kenya, Liberia, Madagascar, Senegal, Uganda	Demonstration of Effectiveness of Diversified, Environmentally Sound and Sustainable Interventions, and Strengthening National Capacity for Innovative Implementation of Integrated Vector Management (IVM) for Disease Prevention and Control in the WHO AFRO Region	9,550,000 & 243,103,508	UNEP	Ongoing
India	Environmentally Sound Management of Medical Wastes in India	10,000,000 & 30,444,000	UNIDO	Completed (2016)

Other GEF -financed HCWM Projects

Country	Project Title	Grant and Co-financing	Implementing Agency	Status
China	Environmentally Sustainable Management of Medical Waste in China	11,650,000 & 33,157,140	UNIDO	Completed (2018)
Regional Caribbean: Antigua and Barbuda, Barbados, Belize, St Kitts and Nevis, St. Lucia, St Vincent and the Grenadines, Suriname, Trinidad and Tobago	Development and Implementation of a Sustainable Management Mechanism for POPs in the Caribbean	8,839,000 & 21,124,103	UNIDO	Ongoing
Senegal	Environmentally Sound Management of Municipal and Hazardous Solid Waste to Reduce Emission of Unintentional POPs	2,000,000 & 17,030,186	UNIDO	Ongoing
Regional Africa: Burkina Faso, Benin, Mali, Niger, Senegal, Togo	Impact Investment and Capacity Building in Support of Sustainable Waste Management to Reduce Emissions of Unintentional POPs (UPOPs) and Mercury in West Africa	15,924,771 & 130,797,229	West African Development Bank (BOAD)	Ongoing
Tunisia	Demonstrating and Promoting Best Techniques and Practices for Managing Healthcare Waste and PCBs	5,500,000 & 11,200,000	World Bank	Completed (2017)

Strengthening regulations for reducing the chemical impact of health care waste

Experiences and lessons learned: UNDP GEF Africa Project

- March 2021 -

Presented by:
Dr. Ute Pieper
WHO Consultant
utepieper@yahoo.de

GEF financed project

Reducing UPOPs and Mercury releases from the health sector in Africa (Ghana, Madagascar, Tanzania and Zambia)

- Implemented by UNDP in collaboration with WHO and HCWH (2016- 2021)

- Overall project objective
  - …to implement **best environmental practices** and introduce **non-incineration** healthcare waste treatment technologies and **mercury-free** medical devices in four Sub-Saharan African countries to reduce harmful releases from the health sector…

to advocate for sustainable development, innovation, and the green economy in the sector…

World Health Organization

Results: Environmental protection - Prevention of Chemicals

- Reduction of Persistent Organic Pollutions (PoPs)
  - Installation of 18 environmentally friendly autoclaves (no generation of dioxins and furans)
  - Direct reduction of UPOPs releases 4.19 g-TEQ/y and indirect reduction 24.42 g-TEQ/
- Phasing out mercury containing thermometers and sphygmomanometers
  - 2,201 mercury containing devices were exchanged with non-mercury containing ones
  - Collected and secured mercury: 57.3 kg

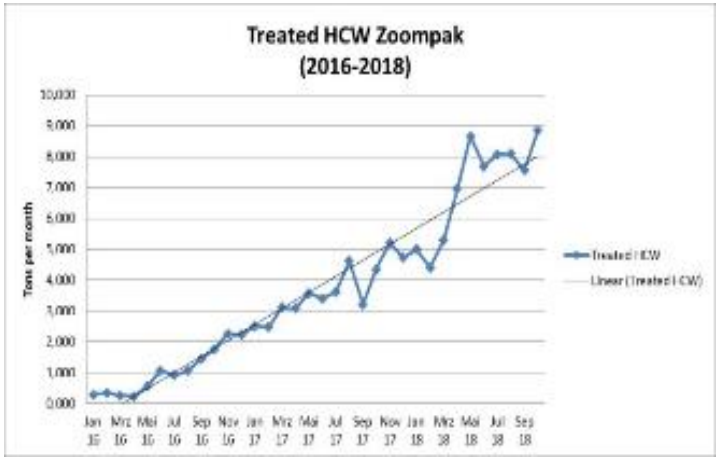
POPs free HCWM system

- Training on HCWM
- Construction of Infrastructure
- Procurement of autoclaves and testing equipment
- Training of service company, operators and technicians
- Data collection of treated waste amounts…
- Establishment of sustainable operation and maintenance financing system

World Health Organization

Example: private sector involvment

- Cooperation of the project with central treatment facility in Ghana: Zoompak
- Initial obstacle:
  - Not sufficient clients - high service charges
- Authorities developed and enforced legal framework on HCWM, which has been supported by the project->
  - No of clients increased
  - Acceleration of POPs reduction



World Health Organization

Mercury Waste: Risk reduction

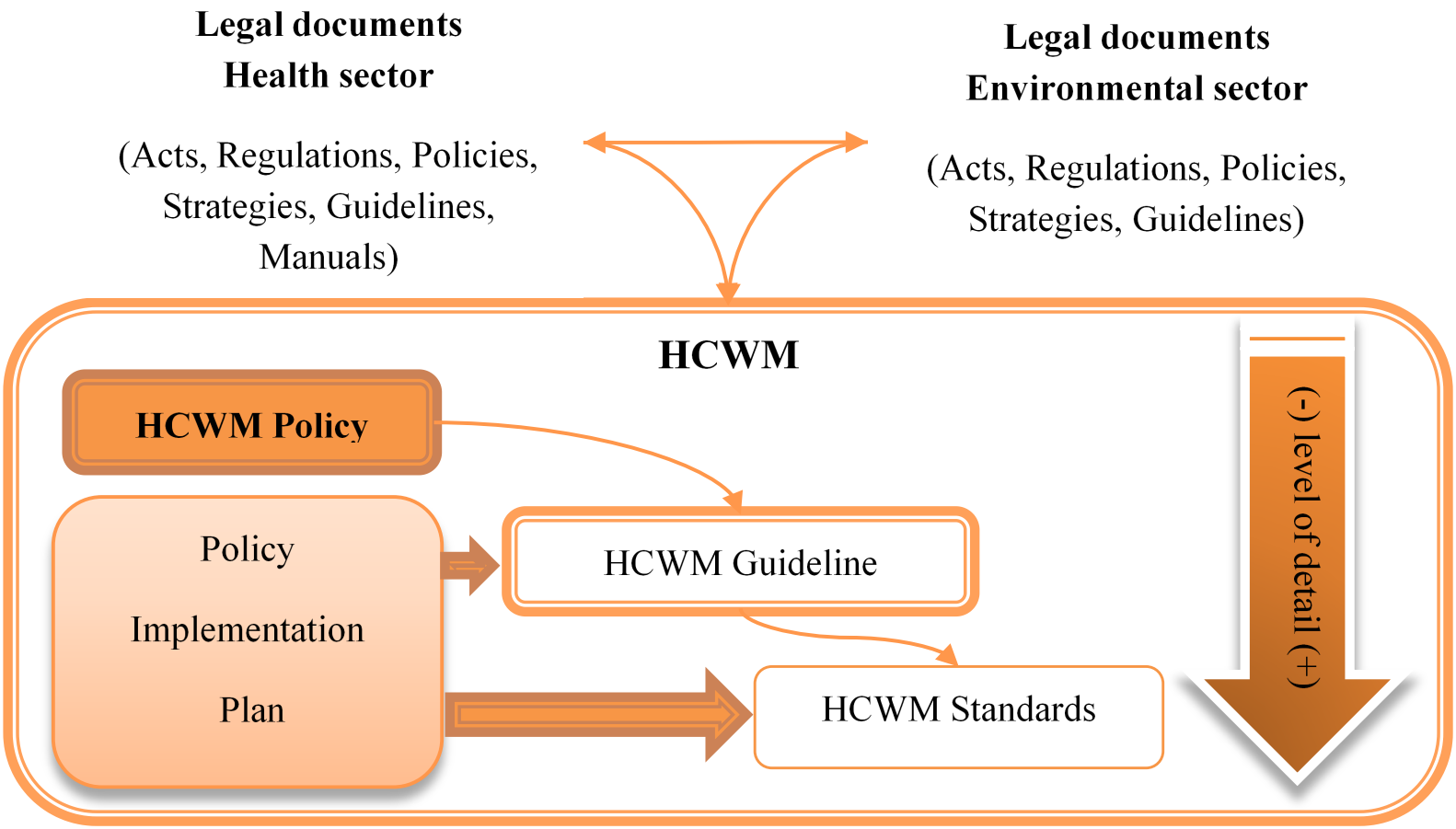
1. Elimination and Substitution
   - Develop and implement a mercury phase-out plan
   - Provision of non-mercury containing devices
2. Engineering control
   - Construct safe mercury storage facilities
3. Administrative control
   - Evaluate causes of spills and adopt preventive measures
   - Conduct awareness-raising and trainings
   - Promote safe handling procedures
   - Use educational posters and warning labels
   - Provide mercury spill clean-up kits
4. Personal protective equipment
   - Use proper PPE during spill clean-up

World Health Organization

Why is the legal framework important?

- Mutual understanding of responsibilities (intersectoral approach)
- Improving and enforcing of standardized HCWM practices – implementation (including
  - Prioritizing of BAT like autoclaving
  - Phasing out of mercury containing devices,
  - Establishing of chemical waste management on national / regional / local level
- Planning of implementing the policy to improve HCWM:
  - preparation of cost estimates on the finance necessary to fulfil the national strategy / plan
- Acknowledge that additional resources will be required
- Reaching sustainability by regular Monitoring and Documentation

Legal framework structure



World Health Organization

Lessons learned: reduction of PoPs

- Develop or revise **legal documents** on safe and environmentally friendly HCWM including BAT, BEP and mercury phasing out
- Institutionalize HCWM **training** in the health service curriculums
- Build capacity on HCWM **budgeting**; and study/support possible (private/public) financial mechanisms to ensure sustainability of HCWM operations.
- Ensure that **operators** are knowledgeable and aware on the operation of the equipment, **technicians are well trained** on the maintenance and repair of the equipment, spare parts are available.
- Provide enough resources for **data collection and communication**- e.g. digital data collection tools, website development and establishment of permanent monitoring systems

Lessons learned: phasing out of mercury

- Procure non-mercury equipment at national / regional level where possible.
- Provide clear guidance and training on validation / calibration of equipment when necessary
- Awareness raising and training on digital equipment on the ground is essential.
- Consider of different sized arm-cuffs during the planning of equipment.
- Disposal strategy for mercury waste should be in line with the country's obligations under the Minamata Convention.

Thank You

For more information and to get involved contact:

washinhcf@who.int

WASH in health care facilities knowledge portal:
www.washinhcf.org

UNDP GEF Africa Project knowledge portal:
www.greenhealthcarewaste.org

World Health Organization

References

- UNEP (2003). Technical guidelines on the environmentally sound management of biomedical and healthcare waste. http://archive.basel.int/pub/techguid/tech-biomedical.pdf
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World Health Organization

Challenges of eliminating toxic waste: Mercury from health care equipment

Webinar on "Chemicals and Waste Management beyond 2020"

Michael Funcke-Bartz 4D60 | 24.03.2021

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

A few words about GIZ..

As a federally owned enterprise, GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.

GIZ participates as stakeholder in the *Strategic Approach to International Chemicals (SAICM)*

GIZ hosts the *ISC3 - International Sustainable Chemistry Collaborative Centre,* established in 2017 in Bonn/Germany by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the German Environment Agency (UBA)

Lessons learnt from a bottom-up approach in Ghana

1. During the Ebola outbreak in Liberia in 2014, the State Chancellery of the German federal state North Rhine-Westphalia approached GIZ to consider a health related component in an ongong project under the partnership with Ghana in the field of climate and resource protection.
2. GIZ recommended to cooperate woth Komfo Anokye Teaching Hospital (KATH) in Kumasi to improve hospital waste management in the second largest hospital in Ghana (1.260 beds)
   - To implement an advanced waste management system and to build capacity
   - To rehabilitate the existing healthcare waste treatment site

Supported by Gefördert durch Die Landesregierung Nordrhein-Westfalen

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Lessons learnt from a bottom-up approach in Ghana

Remaining challenges with „historic“ waste (e.g. mercury containing equipment))

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Global phase-out of Mercury under the 2013 Minamata Convention

- Bans of new mercury mining
- Calls for increased controls on mercury emissions and
- phasing out of mercury use in products and processes.

Mercury-containing health care devices	Alternative equipment
mercury thermometers	digital fever thermometers
mercury sphygmomanometers	aneroid sphygmomanometers

Options for disposal of mercury waste under the Basel Convention Technical Guidelines:

- final disposal of stabilized and solidified mercury in a specially engineered landfill or
- permanent storage of stabilized and solidified mercury in a secure underground storage facility that uses storage vessels specifically designed for the purpose.

Global Mercury Waste Assessment. UNEP, Nairobi 2017

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Need for a holistic approach

- Only a few countries have the technology and equipment for the solidification and stabilization of mercury, and only a limited number of appropriate final disposal facilities are available around the world.
- Countries without facilities of their own can export mercury waste for the purpose of environmentally sound disposal.
- Parties to the Minamata Convention should first develop environmentally sound collection and interim storage pending possible export for treatment and disposal.

Global Mercury Waste Assessment. UNEP, Nairobi 2017

- **Institutions / support projects tend to focus on substituting, collecting, and storing problematic equipment**
- **From a safeguards perspective, it is important to consider the last mile (= safe elimination), too.**

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Structural challenges not only revelant for health care waste

Institutional as well as corporate governance generally foresees quite strict regulations for procurement while requirements and reverse logistics for dealing with obsolete end-of-life equipment tend to be vague or even non-existent.

Possible unintended side-effects

Illegal trade with mercury waste, e.g. for „Galamsey“ gold mining

Electric & electronic devices ending up in the informal scrap business

Possible options to deal with these challenges

Historic toxic waste substitution programmes

- Countries with weak hazardous waste management infrastructure need more support for setting up reverse logistics systems for problematic waste, including final treatment
- If no specially engineered landfills and permanent storage facilities are accessable, treatment outside the country needs to be supported (public-private funding)
- In the case of mercury, stabilization / solidification are recommended to immobilize mercury

Procurement linked with care for end-of-life devices

- If there are no established take-back systems (e.g. EPR-scheme), a dedicated fee for proper recycling/treatment can help to cover expenses at the end-of-life of a product
- If such schemes do not exist yet, procurement of new products should be linked to responsibility to care for recycling/treatment of equivalent number of obsolete products

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Contact

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Section „Environment"

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COVID vaccination campaigns and waste management

Ruth Stringer, International Science and Policy Coordinator
Health Care Without Harm

UNDP/SAICM Webinar
"Chemicals and Waste Management beyond 2020"
Sound Management of Chemicals and Waste: Greening health care waste
24 April 2021

Health Care Without Harm

GLOBAL GREEN and HEALTHY HOSPITALS

The biggest mass vaccination campaign ever

- COVAX aims to provide doses for at least 20% of countries' populations
  - Equivalent to 40 doses per 100 people
  - Globally, >6 doses per 100 people have been delivered so far, and mostly to high income countries
- WHO COVAX facility aims to provide at least 2 billion doses during 2021
  - 74% of global population is over 15 years old so 11.5 billion doses would be needed to vaccinate everyone, assuming 2 doses and no waste.

Principles of waste management for vaccination

Minimise waste

- Ensure products are reusable, wherever possible, especially shipping containers and other packaging
- Reinforce waste segregation, do not over-classify or over package waste
- Provide the right PPE, but not too much- eg aprons and gloves are not essential for vaccinators
- Use needle cutters to reduce syringe waste volume
- Maintain recycling

Avoid incineration

- There is no technical reason why vaccination waste needs to be incinerated
- Avoid regrettable investments in technologies that are not desirable in the longer term

Avoiding toxic substances

- Eg: Expanded polystyrene in cool boxes, PVC in packaging or wiring in refrigeration units, fluorinated refrigerants (greenhouse gases)
- Avoid unnecessary disinfectants. Alcohol and soap are effective against SARS CoV-2

Protect workers

- Prioritise healthcare workers and waste workers for COVID vaccination; Provide PPE

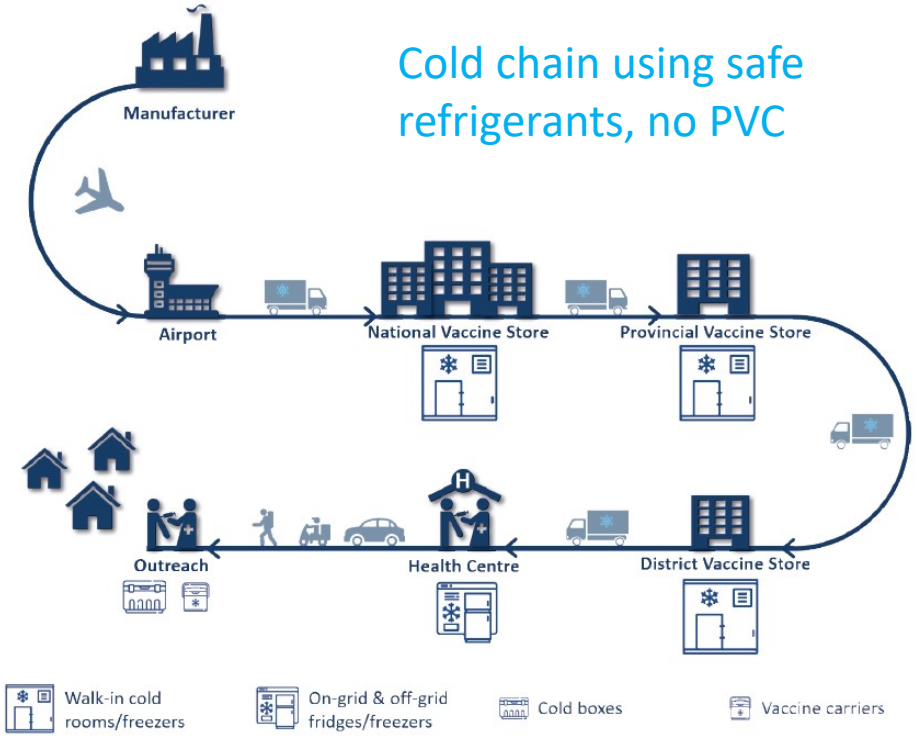
The polluter pays

- Manufacturer engagement and extended producer responsibility mechanisms eg product design and product takeback and environmentally friendly treatment and recycling and disposal.

Waste generation, hazards and options

Waste	Hazards	Avoidance
Packaging	Pollution in production and disposal	Design shippers etc for reuse, avoid PVC and styrofoam, recycle at end of life
Vials	Broken glass- vaccine is not hazardous	Reuse or recycle vials and aluminium caps, use prefilled syringes instead
Syringes	Needle stick injuries, infections	Cut needles, recycle plastic
Disinfectants	Asthma, skill sensitisation, pollution from production and disposal	Avoid persistent disinfectants, use rationally and minimise overpackaged products. Swabs should be biodegradable.
Refrigeration	Fluorinated refrigerants are greenhouse gases, PVC in wiring, dry ice causes burns, suffocation hazard	Use hydrocarbon refrigerants, design out PVC, store and dispose of dry ice in well ventilated areas

Imagining a zero waste immunization campaign- delivery



Cold chain using safe refrigerants, no PVC

Appropriate PPE

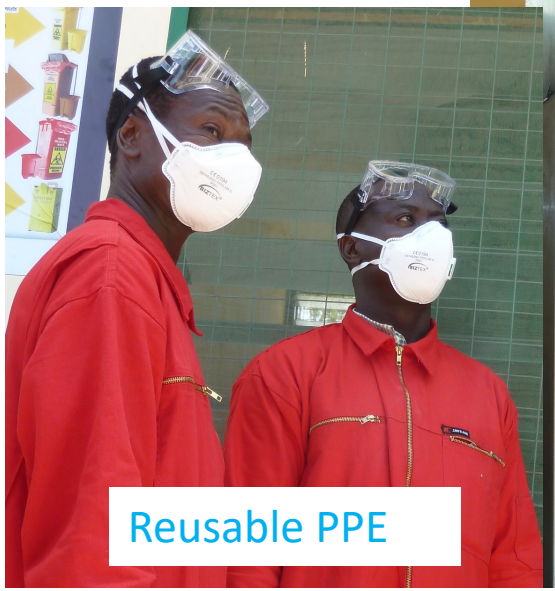
Reusable and recyclable shipping containers

Appropriate, environmentally friendly disinfection, with minimal packaging

Imagining a zero waste immunization campaign- waste disposal

Needle cutters

Reusable sharps containers

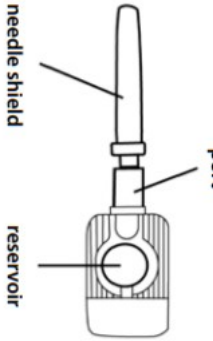


Reusable PPE

Steam disinfection

Robust reverse logistics chain

Reuse, recycle or eliminate vials



Recycle packaging and syringe plastic

Case studies

Philippines Measles Eradication campaign 2004

- Almost 20 million syringes disposed without the need for incineration.
- Centralised disinfection via autoclaves and microwaves proved among the most economical methods, cheaper than burial in cement lined

Nepal vaccine waste disposal 2014

- Tested needle cutters, reusable sharps containers, autoclaving and recycling
- It was possible to recycle: syringe plastic, cardboard and plastic packaging, vials and aluminium caps.
- Autoclaving and recycling was cheaper and had a lower carbon footprint than incineration or open burning.

Madagascar 2018/19

- CHJURA hospital assisted in the autoclaving of vaccination waste.
- Autoclaves for the hospital's own healthcare waste were used to disinfect syringes in sharps boxes from vaccination sites that would otherwise have been forced to open burn waste
- Disinfected waste was shredded for disposal

Chemicals of concern for the health sector

bit.ly/chemicalsofconcernreport

Importance and usage of the list in health sector

- A consolidated list of chemicals of high concern
- Used as a tool by the procurement and sustainability officers to identify chemicals of high concern
- Eliminating and substituting the chemicals of high concern from the supply chain with less toxic and effective alternatives.

Chemical uses in healthcare sector

- Pharmaceuticals, Laboratory Chemicals, Sterilants and Disinfectants, Medical devices, Mercury containing devices, Biocides and pest control, Byproducts of incineration, Buildings, furnishings and floorings

Health impacts

- Carcinogens, Mutagens, Reproductive hazards, Endocrine disruptors, Immunosuppressants, Neurotoxins (mercury), Sensitizers, Asthmagens

Authoritative Lists & Conventions

- Minamata Convention on Mercury, Stockholm Convention on Persistent Organic Pollutants (POPs), Rotterdam Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, Montreal Protocol on substances that deplete the ozone layer, International Agency on Research in Cancer (IARC), EU REACH, California, USA: Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65), WHO's chemicals of major health concern, Sweden's Region Stockholm Phase out list

Substitution of hazardous chemicals

CASE STUDY:
MERCURY SUBSTITUTION

ST. PAUL HOSPITAL, THE PHILIPPINES

Chemicals of Concern for the health sector

CASE STUDY

WASTE MANAGEMENT SYSTEM

NATIONAL KIDNEY CENTER, NEPAL

Chemicals of Concern for the Health Sector

CASE STUDY

INTEGRATED PEST MANAGEMENT

BONGANI REGIONAL HOSPITAL, SOUTH AFRICA

Chemicals of Concern for the Health Sector

Used GeneXpert Cartridges waste management

Disposal of Xpert ® Assay Components Containing Guanidinium Thiocyanate

Standard Operating Procedure (SOP)

&

Heading to proper final disposal

World Health Organization

HEALTH EMERGENCIES programme

Objective

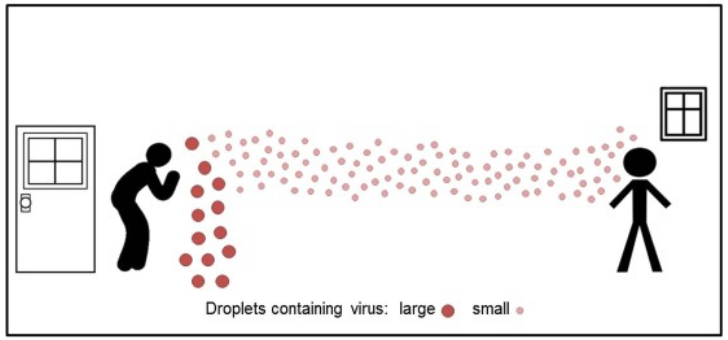
Provide technical recommendations to support the development of a regular system for the proper management of the hazardous waste produced at laboratory facility level, specifically for expired and used GeneXpert cartridges and, for some specific cases, the used lysis buffer´s vials.

The main priority is to support countries to set up proper collection and storage of used GeneXpert cartridges while seeking for the most suitable final disposal procedure in order to reduce the potential public health risk cause by unproper management and disposal.

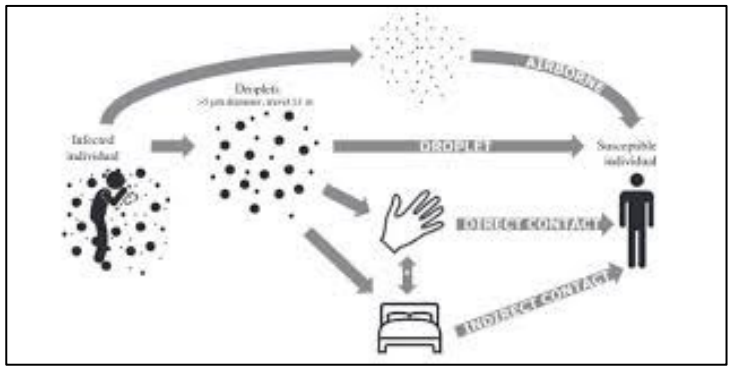
COVID-19 (Respiratory virus) and IPC

Transmission – droplet, fomites, aerosol?

Risk Assessment What processes are you doing, what are the risks, is COVID the only risk?



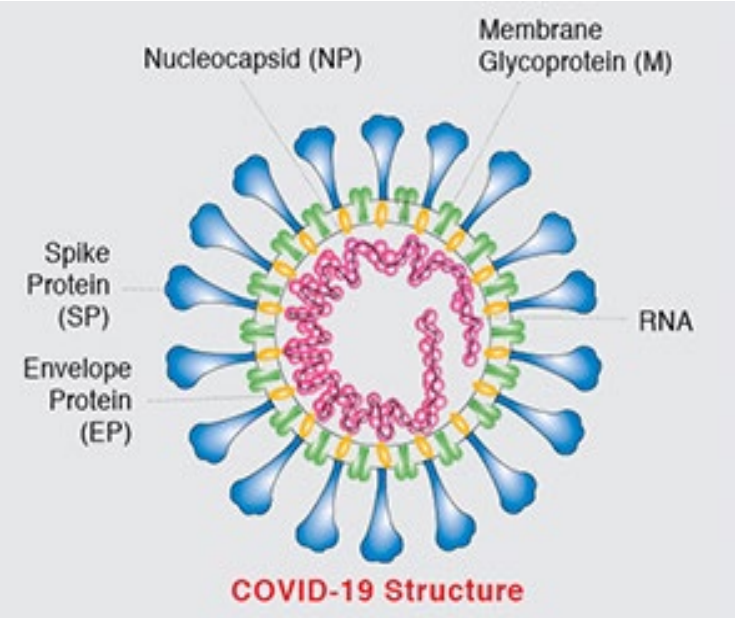
Identify appropriate PPE for the processes and risks.



Ensure all infectious waste is treated appropriately

COVID-19 and Role of the Laboratory - Detect Infection

TYPES OF ASSAYS TO DETECT SARS-CoV-2 INFECTION



- **DIRECT - Detection of virus**
  - Viral Nucleic acid – PCR
  - Viral antigens
- **INDIRECT - Detection of exposure to virus**
  - Antibodies – IgM and/or IgG, IgA

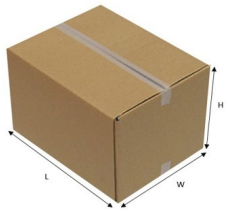
Guanidinium Thiocyanate (GTC)

Numerous nucleic acid amplification preparation protocols and commercial products, including Xpert assays for HIV, HCV, CTNG, and others, use Guanidinium Thiocyanate (GTC) to facilitate extraction of DNA and RNA from cells and prevent nucleic acid destruction by enzymes. If present, GTC is either pre-sealed inside the GeneXpert® cartridge or is present in an external reagent vial (lysis buffer) to be added to the patient sample for loading into the cartridge.

EU CLP	Acute Tox. 5, H302, H313, H320
UN GHS	Acute Tox. 5 (Orl); Skin Irrit. 3; Eye Irrit. 2B
OSHA HCS 2012	Acute Tox. 5 (Orl); Eye Irrit. 2B

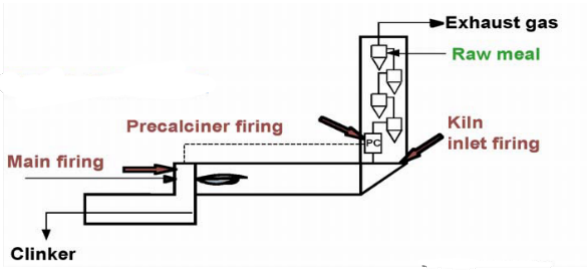
Operational steps

Waste volume estimation

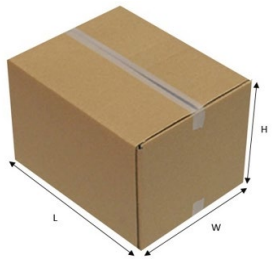


Waste collection & storage

Treatment



Waste volume estimation

GeneXpert cartridge waste management		
Waste volume estimation based on the maximum testing capacity for each laboratory. Only white cells can be modified. Note: for planning waste management activities and budget consider the maximum waste production regardless of real test done per day. This will allow to properly handle any potential peak. To ease the storage and reduce the waste, it's recommended to use the original cartridge cardboard box (the one in which the shipment arrived) to store the used cartridges. This facilitate as well the volume estimation as the cardboard volume is standardized. Please insert the measures as described below using a comma for decimal units).		
How to measure the cardboard box		**Used cartridges per cardboard box** The quantity of new cartridges per cardboard box vary according to the specific Xpert assays. For instance, the Xpert® Ebola is provided with a 50 cartridges per cardboard box while 10 for the Xpert Xpress SARS-CoV-2. To ease volume estimation is recommended to recondition the same number of used cartridges according to the original shipment quantity. i.e. 50 used cartridges per cardboard box for Xpert® Ebola while 10 for the Xpert Xpress SARS-CoV-2. Please write in the white cell the quantity of used
	L (m)	
	0,32	
	W (m)	
	0,24	
	H (m)	
Cardboard box volume (m3) **0,026112**	0,34	15
How to estimate the maximum GeneXpert cycles/runs/loadings per day: ask the laboratory technicians and managers what the turnaround time for one GeneXpert assay result. This time should not be multiplied by the number of samples. i.e. a turnaround time of 2,5 hours for 1 sample is 2,5 hours as well for 4 or 16 samples according to the module configuration. Divide 24 hours (or your working hours if the laboratory is not working 24 hours) by your turnaround time to find your maximum GeneXpert cycles per day.		**How to define the GeneXpert module configuration:** The GeneXpert System is available in a 1, 2, 4, 16, 48 or 80-module configuration. Each module corresponds to 1 test/cartridge i.e. the 4-module configuration allows to run 4 tests at the time. Use the image below illustrating the available module configuration options to identify the system(s) installed in your laboratory.

For planning waste management activities, budget and storage volume needed consider the maximum waste production regardless of the real number of tests done per day. This will allow to properly handle any potential peak.

The Waste estimation tool V3.0 aims to support users forecasting the waste volume over a period of 3 months

Waste volume estimation

Step 4

GeneXpert cartridge waste management - country volume estimation						
Laboratory (name) and location	**GeneXpert system (quantity)**	**GeneXpert module configuration**	**Maximum GeneXpert cycles per day**	**Maximum Cartridges used per day**	**Maximum waste volume/day (m3)**	**Maximum waste volume/month (m3)**
Milan University Lab	1	10	1	10	0,017	0,522
	2	1	3	6	0,010	0,313
	1	1	4	4	0,007	0,209
	1	1	5	5	0,009	0,261
	1	1	2	2	0,003	0,104
	1	1	2	2	0,003	0,104
	1	1	2	2	0,003	0,104
	1	1	2	2	0,003	0,104
	1	1	2	2	0,003	0,104
	1	16	2	32	0,056	1,671
	1	10	1	10	0,017	0,522
	2	1	3	6	0,010	0,313
	1	1	4	4	0,007	0,209
	1	1	5	5	0,009	0,261
	1	1	2	2	0,003	0,104
	1	1	2	2	0,003	0,104
	1	1	2	2	0,003	0,104
	1	1	2	2	0,003	0,104
	1	1	2	2	0,003	0,104
	1	16	2	32	0,056	1,671
	1	1	2	2	0,003	0,104
	1	1	2	2	0,003	0,104
	1	1	2	2	0,003	0,104
	1	1	2	2	0,003	0,104
	1	16	2	32	0,056	1,671
Total	11	34	25	67	**0,117**	**3,499**

Waste collection – Used cartridges

Used cartridges should be triple-packaged in a leak-proof container for disposal. The cartridge itself is the primary containment – be sure that the lids of cartridges are closed tightly before discarding. Discarded items should be placed into a plastic hazardous waste disposal bag in a hard-sided container. The cardboard box in which the shipment arrived is recommended for this purpose. Place the materials into a plastic hazardous waste disposal bag (second packaging; leak-proof) which is placed into a cardboard or plastic box (third packaging).

Waste collection – Used reagent vials

NOTE: Several GeneXpert Tests do NOT require reagent vials.

Used vials should be triple-packaged in a leak-proof container for disposal. The vial itself is the primary containment – be sure that the caps of vials are closed tightly before discarding. Discarded items should be placed into a plastic hazardous waste disposal bag in a hard-sided container (to simplify the collection is advisable to use the same transparent plastic bag used for shipment). Place the materials into a plastic hazardous waste disposal bag (second packaging; leak-proof) which is placed into a cardboard or plastic box (third packaging).

Waste collection – Labelling

Label the closed cardboard box as shown in the table below including the hazard symbol

Facility name:	Write the name of the laboratory	Hazard symbol
Unique ID	Provide and write a unique ID for each carton. E.g. (GX-SARS-CoV-2) /0001_ Serial number (From Covid-19 test) (GX-EVD) /0001_ Serial number (From EVD test) (GX-TB) /0001_ Serial number (From TB test) (GX-HIV) /0001_ Serial number (From HIV test)	GHS05 (Corrosivity) 
Date and time:	Write date and time when the carton is closed	
N° of cartridges:	Write total number of used cartridges contained in the carton.	
N° of vials:	Write total number of used vials contained in the carton.	
Responsible:	Write the name of the person in charge of waste collection	

Temporary storage

- Each laboratory shall be responsible for the temporary storage of its own waste which must be stored in an appropriate place (Describe in the SOP shared to member states). This room should be in a well identified location within the structure, preferably detached from the other buildings, but still easily accessible from the laboratory and also from the potential elimination area.

- All the hazardous waste needs to be registered on **the stock cards,** mentioning all the information as reported on the label. In order to recognize these products for correct elimination afterwards, it's advisable to record the unique ID.

Annex 2. Printable Stock card

STOCK CARD
GeneXpert used cardridge

N°:

Laboratory:	
Laboratory lead	
Cartridge collection responsible	
REMARKS	

sn	Date of storage	From laboratory for storage/From stock for disposal			Curent stock	Any remarks and signature
N°	DATE	FROM / DESTINATION	IN	OUT	STOCK	OBSERVATION
		STOCK ON LAST CARD				
1						
2						
3						
4						
5						
6						

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Treatment

A safe way to destroy product containing Guanidine Thiocyanate could be by double combustion incineration (even rotary kilns have a post-combustion chamber). The Stockholm convention standardizes the combustion conditions that should be reached:

Minimum temperature of 850 °C and 2 seconds retention time in the 2nd combustion chamber.	→ Medium temperature incineration
Minimum temperature of 1100 °C and 2 seconds retention time in the 2nd combustion chamber if the halogen content of the waste product > 1%.	→ High temperature incinerator

Waste treatment selection roadmap

Waste treatment legislation

For the treatment of used GeneXpert cartridges, investigate if there is national legislation governing the disposal of biological or hazardous material and **abide by the directions provided in the legislation.**

If **commercial entities** exist in the context of biological or hazardous waste disposal, ensure that any company abides by the governing legislation prior to engaging them to handle your waste.

Waste exportation

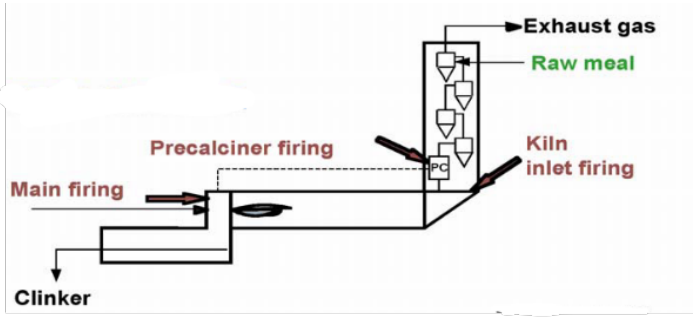
The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal is a multilateral agreement negotiated under the United Nations Environment Program (UNEP). The Basel Convention establishes standards for the transboundary movement of hazardous waste, solid waste, and municipal incinerator ash, including notice to and written confirmation from the receiving country prior to export.

UNEP BASEL CONVENTION

Waste treatment selection roadmap

Co-incineration in a Cement factory

Cement kilns have for more than three decades been used to recover energy and materials, to co-process alternative fuels and raw materials and to treat organic hazardous wastes in a number of countries. This practice normally combines energy and resource savings with effective waste management, and can be extremely attractive and cost-efficient, especially for emerging economies having insufficient waste treatment capacity



THANKS FOR YOUR ATTENTION

Reducing UPOPs and Mercury release from the Health sector in Africa

Presented by Solofonirina RABERAHONA

National Consultant

UPOP Project

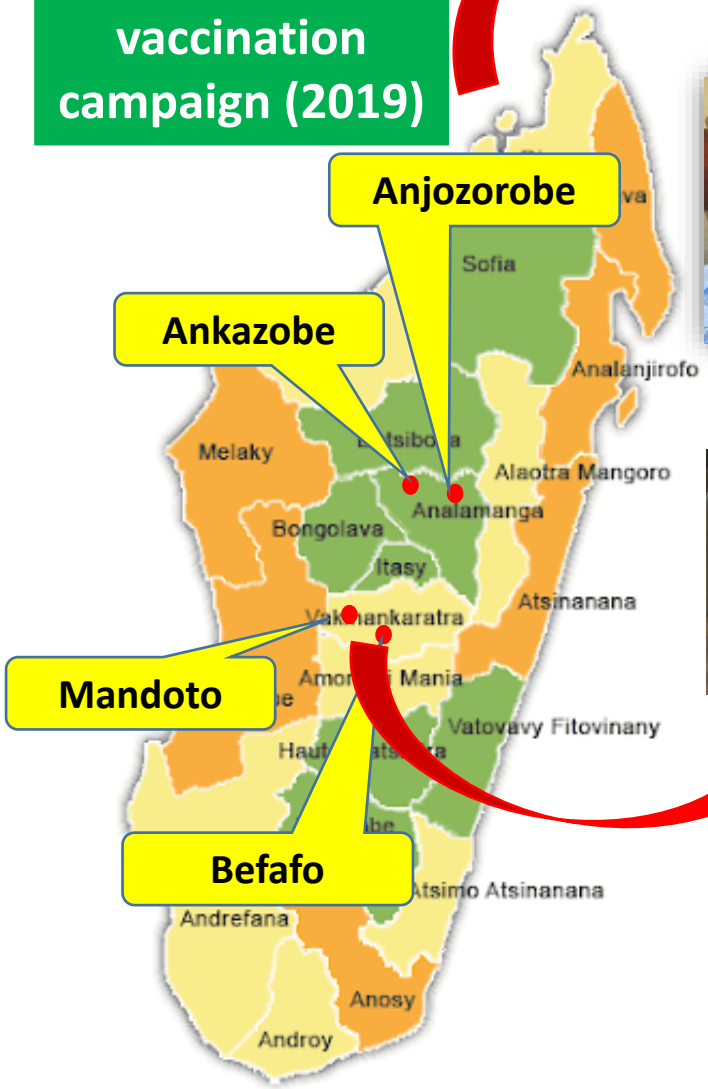
March 2021

Madagascar’s experience :

- Waste recovery and treatment during Vaccination campaign

- Remote installation and training

3rd phase of national measles vaccination campaign (2019)



Treatment by autoclave

JSD 1300 du CHU JRA

Syringes & Glass vial

Recovery and transport of wastes from 4 districts by Standardised vehicules for transportation of Dangerous Waste provided by project
Qty : 198 Kg

MINISTERE DE L'ENVIRONNEMENT, DE L'ECOLOGIE ET DES FORETS

World Health Organization

Health Care Without Harm

gef

PNUD
Au service des peuples

Remote installation

- Restrictions due to COVID 19 prohibiting the movement of technicians (South Africa) for the installation of the autoclave 450L (JSD 440)
  - ✓ Remote installation of the autoclave with MEDICLAVE, Medical International a local representative of TTM (Supplier) and technicians from Ministry Of Health (Maintenance service) and the hospital
  - ✓ By Zoom, Skype and WhatApps
  - ✓ Interpreter
  - ✓ Duration : 4 days

Unpackaging

Installation of piping

Positioning of autoclave

Functional testing

World Health Organization

Health Care Without Harm

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Au service des peuples

Remote training on preventive maintenance of JSD 1300 & JSD 260

- Restrictions due to COVID 19 prohibiting the movement of technicians (South Africa) for maintenance of JSD 1300 and JSD 260 :
  - ✓Remote training with MEDICLAVE
  - ✓ Participants (10 people) :
    - Technicians from : CHU JRA , CHU JRB, Service of maintenance Ministry Of Health, National consultant
  - ✓ By Zoom, Skype and WhatApps
  - ✓ Interpreter
  - ✓ Duration : 2 and ½ days

Explanation of the control panel of JSD 260

Replacing the door gasket of JSD 260

Checking, replacement of a JSD 1300 element

Replacing a JSD 260 valve

Tightening the screws of the JSD 1300 contactors

Main achievements

- ❑ 4 autoclaves installed
- ❑1175 thermometer and 442 shygmomanometer without mecury distributed to 8 model healthcare facilities
- ❑More than 2300 thermometer exchanged
- ❑ 30,65 T of infectious waste treated (CHU JRA, CHU JRB)
- ❑ 0,95 gTeq/ an of UPOP avoided
- ❑ 2,7 Kg of mercury recovered

Misaotra Tompoko

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