



Disposal of Xpert[®] Test Cartridges

Rumbidzai Ndungwani
Public Healthcare Programs Manager
ASLM LabCop
02 May 2024

Agenda

- 1 Purpose of the Bulletin
- 2 Xpert® Virology Tests and GTC Tests
- 3 Routine Disposal of GTC-Containing Reagent Vials and Cartridges
- 4 Resources for LMIC Waste Issues

Purpose of the Waste Management Bulletin



Intended Use


- Share updated information on the guanidine thiocyanate (GTC) quantities in specific Xpert® cartridges, highlighting the associated risks.
- Provide recommendations to countries on effectively managing waste from tests performed on the GeneXpert system.
- Suggest the best approaches for disposing of solid and chemical waste.



Virology Xpert® Tests and GTC content



TEST	GTC PRESENT	TOTAL GTC VOLUME IN A CARTRIDGE (ML)*	% GTC IN REAGENT PRODUCT ¹
XPERT® HIV-1 QUAL XC**	No	None	None
XPERT® HIV-1 QUAL	Yes	1.4 ml per cartridge	10-20%
XPERT® HIV-1 VIRAL LOAD XC	Yes	2.0 ml per cartridge	10-20%
XPERT® HIV-1 VIRAL LOAD	Yes	2.0 ml per cartridge	10-20%
XPERT® HCV VIRAL LOAD	Yes	2.0 ml per cartridge	10-20%
XPERT® HCV VL FINGERSTICK	Yes	1.0 ml per cartridge	10-20%
XPERT® HBV VIRAL LOAD	Yes	1.7 ml per cartridge	10-20%
XPERT® CT/NG	Yes	2.5 ml per cartridge	10-20%
XPERT® EBOLA	Yes	2.5 ml per bottle	10-15%
XPERT® BCR-ABL	Yes	2.9 ml per ampoule	10-15%
XPERT® C. DIFFICILE (XPERT® C. DIFFICILE/EPI, XPERT® C. DIFFICILE BT)	Yes	2.0 ml per pouch	20-30%
XPERT® EV (ENTEROVIRUS)	Yes	300 µl per cartridge	1 - 3%
XPERT® FLU, XPERT® FLU/RSV XC (INFLUENZA/ RSV)	Yes	1.5 ml per cartridge	10-20%
XPERT® MRSA,	Yes	1.5 ml per vial	20-30%
XPERT® MRSA/SA SSTI		2.0 ml per pouch	20-30%
XPERT® SA NASAL COMPLETE	Yes	2.0 ml per vial	20-30%
XPERT® NOROVIRUS	Yes	2.7 ml per cartridge	20-30%
XPERT® TV (TRICHOMONAS VAGINALIS)	Yes	1.6 ml per cartridge	5-10%

 The **GTC content of used cartridges is low** and as such the cartridge waste poses a **minimal risk** ranging from acute toxicity when ingested, to skin and eye irritation¹.

Routine disposal of sample reagent vials and cartridges containing GTC *(either before or after use)*



1. Handling, storage, and transportation of hazardous healthcare waste

- As with all medical waste, used GTC-containing vials and cartridges should be packaged in a leak-proof container and should be separated from other forms of waste to ensure that they go through the appropriate treatment and disposal processes. Typically, this would be as follows:
 - **Primary containment:** The vial or cartridge itself is the primary containment – be sure that the caps of vials and lids of cartridges are closed tightly before discarding.
 - **Secondary containment:** Discarded items should be placed into a plastic, leak-proof, hazardous waste disposal bag.
 - **Tertiary containment:** A hard-sided container should be used as the final level of containment. The cardboard box in which the shipment arrived, or another cardboard box can be used for this purpose.
- Seal and label the external package as “Biowaste” or “Chemical waste” in accordance with the guidelines of your country before removal to the final disposal facility. Refer to the World Health Organization (WHO) guidelines² where the country guidelines are not available

Routine disposal of sample reagent vials and cartridges containing GTC (*either before or after use*)



2. Biohazardous waste disposal

- Cepheid does not recommend placing vials or cartridges containing GTC into a diluted bleach solution bath or tub. Contact between GTC and bleach may release hazardous gas, which should be avoided with ample ventilation. For complete destruction, we recommend that cartridges and reagent vials containing GTC be disposed of using high-temperature **incineration preferably above 1000°C³**.
- Preferably, disposal of all laboratory testing plastics and containers is accomplished by incineration. This recommendation applies to all such products and not just those of Cepheid. Incineration of all Xpert[®] cartridges should follow World Health Organization (WHO) recommendations. Specifically, for GTC-containing waste, WHO recommends double combustion incineration³, preferably at temperatures above 1000°C as detailed by WHO available for download at: <https://apps.who.int/iris/bitstream/handle/10665/43123/9241592745.pdf>
- In addition, the WHO proposes additional practical solutions for the safe disposal of GTC-containing waste through high-temperature **co-incineration of GTC waste in cement factory kilns**. This method has been explored and identified as an effective, inexpensive, and high-capacity disposal option for GTC-containing waste in low-resource settings. Cement factories offer ideal conditions for high-temperature incineration > 1400 °C at the burner side and > 1050 °C at the entrance side^{3,4}
- In countries where there are no incinerators **outsourcing waste management to private companies** is an alternative that has been used in some settings.⁵
- Cepheid understands the inconvenience of disposing of the plastics and reagents generated using Xpert[®] tests and most other molecular tests, but we are committed to working with programs to develop solutions to minimize this impact while continuing to provide the great benefits of accurate and fast near-patient diagnosis.

1. <https://apps.who.int/iris/bitstream/handle/10665/43123/9241592745.pdf>

2. <https://aslm.org/wp-content/uploads/2023/05/LabCoPCookbookWasteMgt-Recipe-EN.pdf?x89467>

3. <https://www.sciencedirect.com/science/article/pii/S2666911021000186?via%3Dihub>

Routine disposal of sample reagent vials and cartridges containing GTC (either before or after use)



3. Response to spills or physical contact with GTC from reagent vials or cartridges

- GTC is irritating to skin and mucous membranes and should be washed with soap and water after exposure. Flush the area with running water as quickly as possible, and then wash with soap and water (if appropriate). For eye exposure, flush your eyes with copious amounts of water.
- A spill from **a single cartridge or a reagent vial onto a laboratory surface would contain a maximum of 1.5 mL of 10-20% GTC.** We recommend that the worker wear gloves and protective eyewear and use paper towels to wet the area of the spill thoroughly with water and detergent, which will remove the chemical components, then dry the area with paper towels, being certain to remove all residual liquid before final disinfection with 10% (0.5% final active concentration) household bleach (or 1% v/v sodium hypochlorite) in water.
- **Alternatives to bleach**, such as OxiClean (Church & Dwight Co., Ewing, New Jersey), a stabilized acidified version of hydrogen peroxide disinfectant, is even safer than bleach, but it is not available everywhere. A hydrogen peroxide/acetic acid combination (7.35% H₂O₂ and 0.23% peracetic acid), such as SporGon (Decon, King of Prussia, Pennsylvania) is also effective for disinfecting spills containing GTC without producing any hazardous byproducts. However, although most bacteria and viruses are killed in 5 minutes, Mycobacteria require 15 minutes of contact for killing, whereas spores require 3 hours of contact.
- If a liquid spill from a used cartridge containing GTC is sprayed with 10% bleach or is cleaned up using bleach-wetted paper towels, the risk of harm from any gaseous products, such as hydrogen cyanide, is very low since the cartridges contain concentrated sodium hydroxide that is mixed with the GTC during operation of the cartridges.

Resources for LMIC waste issues

- [WHO-FWC-WSH-17.05-eng.pdf;jsessionid=91A3806F2AF2049CCD058A09A062C2EA](https://www.who.int/publications/m/item/WHO-FWC-WSH-17.05-eng.pdf?jsessionid=91A3806F2AF2049CCD058A09A062C2EA)
- <https://aslm.org/wp-content/uploads/2023/05/LabCoPCookbookWasteMgt-Recipe-EN.pdf?x89467>
- <https://apps.who.int/iris/bitstream/handle/10665/43123/9241592745.pdf>



**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: dpb9@cdc.gov

Safe management
of wastes from
health-care activities

A summary

World Health
Organization

**LabCoP
Cookbook
of best practices**

RECIPE #7: MANAGEMENT OF GUANIDINIUM THIOCYANATE
CONTAINING WASTE FROM TESTING LABORATORIES

Policy
Regulation
Funding
Coordination
M&E
Implementation