Technical Brief: Sustainable Health Care Waste Management

17 FEBRUARY 2020 **GENEVA, SWITZERLAND**

The Global Fund

Acronyms

ARV: antiretroviral

ACT: artemisinin-based combination therapy

AT: alternative treatment

CDC: United States Centers for Disease Control and Prevention

EMEA: European Medicines Agency

GAVI: Gavi, the Vaccine Alliance

GEF: Global Environment Fund

GHS: Globally Harmonized System of Classification and Labelling of Chemicals

HCF: health care facility

HCW: health care waste

HCWM: health care waste management

HTI: high temperature incineration

ICRC: International Committee of the Red Cross

IETC: International Environmental Technology Centre

LLIN: long-lasting insecticidal net

MSW: municipal solid waste

PPE: personal protective equipment

PPP: public private partnerships

RDT: rapid diagnostic test

SDS: safety data sheet

UNDP: United Nations Development Programme

UNEP: United Nations Environment Programme

UNICEF: United Nations Children's Fund

WASH: water sanitation, and hygiene

WEEE: waste electronic and electrical equipment

WHO: World Health Organization

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1. Executive summary

Driven by its core mission to end the HIV, TB and malaria as epidemics, the Global Fund was designed as a dynamic partnership to best meet the needs of a changing world context. In its evolution, it has also become more responsive as a partnership to the changing global health landscape and aware of its important contribution to achieving the Sustainable Development Goals (SDGs). Environmental sustainability and responsibility, in particular, have emerged as important aspects of the SDGs as environmental degradation, the generation of ever-increasing waste, pollution and climate change are now a real threat to human and environmental health.

While the provision of high-quality health services – including for HIV, TB and malaria – improves health and wellbeing overall, unfortunately, it may result in the generation of potentially harmful waste if not managed appropriately. The Global Fund, accordingly, encourages applicants to address environmental concerns and to incorporate sustainable health care waste management practices into their operations.

The Technical Brief on Sustainable Health Care Waste Management has been designed with such a vision in mind. The purpose of this document is to guide applicants preparing Global Fund funding requests that include interventions related to sustainable health care waste management (HCWM). It highlights the general principles that underpin a sustainable health care waste management system, outlines the scope of Global Fund support and provides information on best practices in HCWM.

In general, the Global Fund recommends key aspects in planning sustainable HCWM interventions. They are summarized below and should guide applications as they consider how to best address environmental concerns while ensuring programmatic integrity.

Key aspects in planning sustainable health care waste management interventions:

- Identify health product waste types generated under Global Fund grants and assess the potential environmental impact;
- Consider preferred forms of waste management and integration with key principles in sustainable waste management;
- Assess level of capacity within the existing national HCWM system;
- Establish key stakeholders and consider the approach to engagement;
- Identify relevant national HCWM legislation and the approach to compliance with regulation and international conventions;
- Appraise national HCWM policy and how interventions can be used to support effective implementation;
- Budget for future HCWM needs and identify opportunities for other forms of investment; and
- Consider approaches towards the measurement of HCWM coverage and evaluate changes in service provision.

Applicants, including country stakeholders, members of the Country Coordinating Mechanism (CCM), technical assistance providers and writing teams, are encouraged to review this document in parallel with the resources available for this allocation cycle, including the HIV, TB, malaria and RSSH Information Notes, related technical briefs such as the Technical Brief on In-Country Supply Chains and the Global Fund Applicant's Handbook.

2. Introduction

2.1 Rationale for investing in sustainable health care waste management systems

Health care waste (HCW) is an inevitable byproduct of providing health services, including for those HIV, TB and malaria services financed by Global Fund grants. HCW can be potentially harmful to both the environment and human health. Not only does improperly managed HCW cause contamination, pollution, unnecessary carbon emissions and waste of resources, it can also pose a danger to patients, health workers and the general public.

Sustainable HCWM is, therefore, essential to reducing the impact of large-scale health interventions on human health and helping to safeguard against environmental effects.

The Global Fund encourages countries preparing Global Fund funding requests to include interventions that take into consideration the environmental impacts of the grants, a key aspect of which is avoiding, reducing and safely managing HCW.

2.2 Sustainable waste management

Sustainable waste management broadly seeks to reduce the amount of natural resources that are consumed by reusing, recycling or recovering materials as many times as possible before they reach the end of their useful life. It also ensures that any waste generated is kept to a minimum and is disposed of in a manner that minimizes environmental harm.

2.2.1 Definitions: Health care waste

'Health care waste', more specifically, includes all the waste generated within health-care facilities, research centers and laboratories related to medical procedures. In addition, it includes waste originating from minor and scattered sources, including waste produced when health care undertaken in the home (e.g. home dialysis, self-administration of insulin, recuperative care)[1].

Certain types of HCW are of a hazardous nature. Hazardous waste displays one or more of the following properties: explosive, oxidizing, highly flammable, flammable, irritant, harmful, acutely toxic, carcinogenic, corrosive, infectious, toxic for reproduction, mutagenic, sensitizing, ecotoxic, or capable of yielding another substance after disposal which possesses any of the characteristics listed above.[2]

2.2.2 Types of health care waste generated through HIV, TB and malaria programs

Health products procured locally or sourced through the Global Fund can account for a large proportion of total HCW and can lead to the

Key facts about health care waste management:

- Of the total amount of waste generated by health care activities, about 85% is general, non-hazardous waste;
- The remaining 15% is considered hazardous material that may be infectious, toxic or radioactive – but can contaminate non-hazardous waste if not handled properly;
- Every year an estimated 16 billion injections are administered worldwide, but not all of the needles and syringes are properly disposed of afterwards;
- Open burning and incineration of HCW can result in the emission of dangerous gasses and particles; and
- Measures to ensure the safe and environmentally sound management of HCW can prevent adverse health and environmental impacts from such waste including the unintended release of chemical or biological hazards, including drug-resistant microorganisms, into the environment thus protecting the health of patients, health workers, and the community.

[1] https://www.who.int/water_sanitation_health/publications/safe-management-of-wastes-from-healthcare-activities/en/
[2] Directive 2008/98/EC of the European Parliament and of the European Council of 19 November 2008 on waste and repealing certain Directives

generation of a range of HCW types. Given the scale of the investment it is essential that environmentally responsible procurement and supply chain management are taken into account. Waste management considerations for key health products types supported by the Global Fund are identified in Appendix A.

3. Key principles of sustainable health care waste management

Several key principles underpin well defined and sustainable waste management policy, practice and implementation.

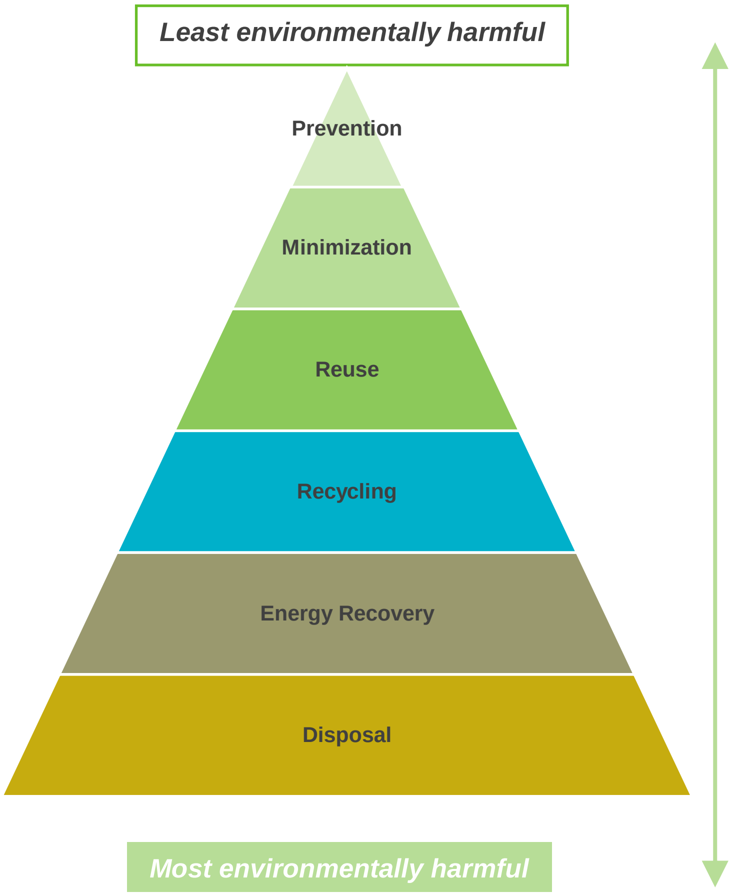
> Note: HCWM interventions supported through Global Fund grants should be **designed and implemented in accordance with these principles.**

3.1 The waste hierarchy

The waste management hierarchy (Figure 1) is important given the intrinsic environmental and health risks associated with managing and needing to control potentially hazardous substances and infectious wastes. The hierarchy should be applied building upon the following concepts:

- Prevention: procure health care products that use less material; use less hazardous products (and generate less hazardous waste) or those that are derived from recycled materials (e.g. for packaging); use more biodegradable materials; ensure good storage and stock rotation so that products are used prior to expiration;
- Minimization: procure only what is needed by assessing health care facility and patient needs; consider the quantity and quality of packaging when procuring health care products (e.g. carton-less medicine bottles) and equipment;
- Preparing for reuse: check, maintain, clean, repair and refurbish whole items (such as electrical equipment) or unused health care equipment;
- Recycling: turn waste into a new substance or product where possible (for instance repurposing LLINs that have reached the end of their useful life into rope or curtains, or collecting non-contaminated packaging for recycling where markets exist);
- Recovery: recover primarily through the generation of energy from waste, or by treating infectious waste to render it safe for disposal;
- Disposal: dispose in landfill and/or incinerate without energy recovery.

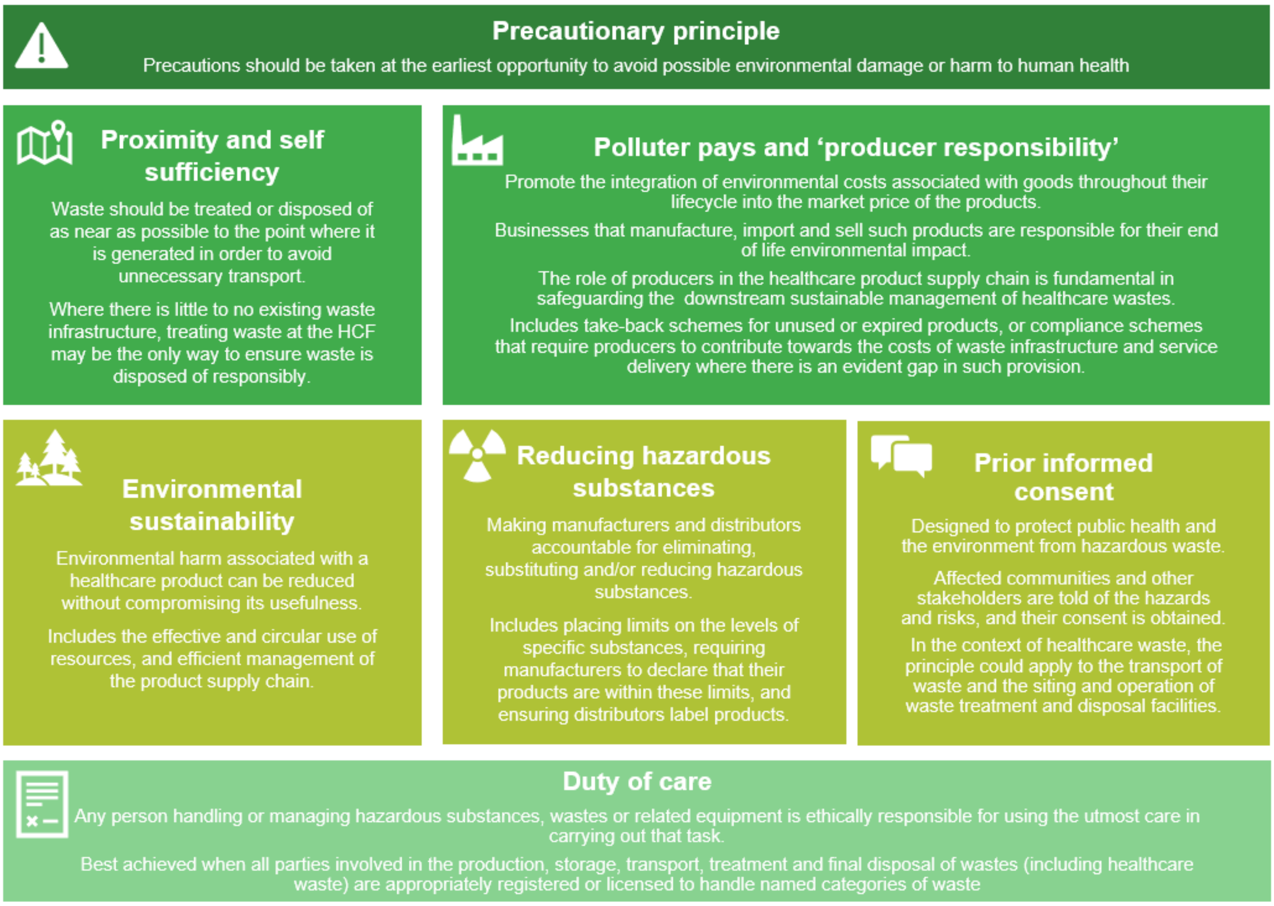
Figure 1: The waste management hierarchy



3.2 Guiding principles

Other guiding principles should also be considered when implementing a systems approach towards HCW management. As illustrated in Figure 2, these mainly focus on dealing with waste as close to the point of production as possible and introducing mechanisms that encourage producers to take greater responsibility for the environmental effects of health products.

Figure 2 Summary of sustainable waste management principles



Source: Mott MacDonald

4. Global Fund support for sustainable health care waste management

4.1 Context

The Global Fund will support waste management interventions that contribute to the development of an integrated and sustainable waste management system – one which considers all aspects from waste avoidance through to safe disposal. Effective waste management should be seen as an integral part of health care systems strengthening and not as an add-on or after thought.

Countries are usually the major investors in their own waste management systems, however both development partners and private sector may also contribute. Sectors other than health must also be actively involved. Therefore, it is essential that investments are well coordinated and aligned with a national vision and HCWM policy.

While HCWM should be an integral part of health systems and national disease programs, few countries have a comprehensive system in place that assigns roles and responsibilities. In fact, most countries have little insight into the type and the quantity of HCW that is actually produced both in the public and private sector. This undermines efforts to plan and budget for appropriate interventions and infrastructure. The development of an informed strategic approach can help address this challenge.

When requesting funds for HCWM under the Modular Framework, applicants must demonstrate how they will support a coordinated approach to strengthen waste management system. Specifically, investments should help reach the following objectives:

1. Avoid and minimize waste through the responsible procurement of health products, whilst reducing the carbon footprint through the supply chain and complying with international legislation;
2. Improve all components of the national HCWM system through the development of strategic policies, operational plans and guidelines;
3. Increase awareness and competency in sustainable HCWM through training and engagement across both public and private sectors, supported by the establishment of partnerships;
4. Demonstrate innovation in HCWM methods for specific health products that comply with the waste hierarchy, are safe and environmentally friendly, and follow robust risk assessment;
5. Address gaps in HCWM infrastructure and equipment whilst in compliance with environmental and occupational health standards; and
6. Demonstrate evidence of long-term financial planning, particularly where Global Fund financing is supported or complements investments by third parties.

4.2 Strategic waste management planning and implementation

4.2.1 Identifying gaps and needs

When developing waste management plans at national level, it is important to assess the existing level of services within the system, identify gaps and determine the capacity to handle future improvements. This requires an examination of current practices, the degree to which legislation exists and is successfully implemented, and the human and infrastructural resources available to handle and treat waste. Assessment of existing capacity, along with waste auditing at the health facility level should be one of the first steps taken in planning HCW interventions.

A Capacity Assessment for Health Care Waste Management has been developed to help applicants self-assess the existing level of maturity to manage HCW, and to help identify areas for future improvement and/or where future HCW interventions could be targeted.

A number of other tools have also been published by other organizations to help support national system development. This includes a HCW maturity model[3] developed by Gavi and UNICEF applicable specifically for immunization waste; a costing analysis tool[4] developed by WHO to plan budgets for HCWM equipment, and a toolkit[5] developed by USAID to assess national supply chain capability.

Capacity Assessment for Health Care Waste Management:
Applicants should the **tool to identify elements of the system where interventions could help to strengthen waste management system capacity**. Applicants are encouraged to **engage with other organizations** and government agencies to help provide robust responses to questions.

4.2.2 Engaging key stakeholders

Key stakeholders, summarized below in Table 2, should be effectively engaged during the process to develop a sustainable HCWM system.

Table 2 Key HCW stakeholders

SECTOR	STAKEHOLDER	ROLE
Public	Ministry of Environment	Enactment of waste management legislation Waste management regulation and enforcement Development of regulatory guidance Development of national waste management strategy and policy
	Ministry of Health	Development of health care waste management standards Establishment of H&S standards Regulation, enforcement and monitoring of H&S compliance
	Ministry of Finance	Establishment of waste management financial plan
	Department for Transport	Establishment of waste transport standards Regulation, enforcement and monitoring of waste transport activities
	Drug Administrator	Regulation of drug testing, development and marketing process
	Regional and Local Authorities (e.g. state and district level)	Implementation of national HCWM policy Development of local plans and targets

[3] Healthcare Waste Maturity Model, GAVI/UNICEF (2020)
[4] Healthcare Waste Management Costing Analysis Tool, WHO (2016)
[5] National Supply Chain Assessment Toolkit, USAID

		Governance of local waste management contracts (e.g. collection and/or disposal)
	HCF	Management of HCW at source Compliant segregation and storage
Private	Waste collection service provider	Collection of health care wastes under contracted or 'paid for' service Upskilling and training of workforce
	Waste treatment and/or disposal service provider	Treatment and/or disposal of health care wastes under contracted or 'paid for' service Upskilling and training of workforce
	HCF	Management of HCW at source Compliant segregation and storage
	Product suppliers	Offer take-back and reverse logistics for expired or unused products Facilitate training and/or knowledge sharing
Informal	Community based waste collection and disposal service provider Communities	Collection, treatment and disposal of health care wastes through informal or ad-hoc arrangements Development and implementation of awareness raising campaigns Local recycling and reuse initiatives
Financing Organizations	Investors	Provision of loans or equity to implement new waste infrastructure
	Financing institutions (e.g. WB, EIB, ERDB, ADB etc)	Provision of grants and/or long-term loans to support capital investments in new waste infrastructure
Funding and Technical Organizations	WHO, UNDP, CDC, Red Cross, USAID, UNEP	Provision of funds to implement waste management interventions and sourcing of health products Development of HCW guidance at international level

In addition to the country level stakeholders, applicants should also consider the role of international regulators in HCWM system development, including those who regulate the production of health care products and assessment of environmental risk. Established regulatory entities in the European Union, United States and Australia are fairly consistent in requiring health product producers to report on specific waste management and environmental standards, but this is not the case in other parts of the world. The European Medicines Agency (EMEA) has produced guidelines on the approach to environmental risk assessment[6] in authorizing pharmaceutical products.

[6] Guideline on the Environmental Risk Assessment of Medicinal Products for Human Use, EMEA, 2006

4.2.3 Compliance

Compliance with international, national and local waste management legislation and regulation is an imperative if the impact from HCW to the environment and human health is to be mitigated.

Most governments publish legislation online. Others may issue legislation in paper format, sometimes called gazettes. It may be possible to obtain copies of these documents from a government office or public library.

4.2.3.1 National regulation

An efficient and effective national regulatory system is an essential component of any resilient health system and a critical enabler as assurance mechanism to health products[7] and regulation at national level is key in underpinning sustainable waste management system development. It is expected that the regulatory framework includes waste classification, monitoring, enforcement, health and safety with specific regulation established in the areas of:

- Permitting and licensing;
- Waste reduction;
- Toxics reduction;
- Procurement;
- End of waste criteria;
- Producer responsibility;
- Hazardous waste;
- Treatment and disposal technologies
- Waste transportation
- Worker health and safety;
- Landfill management; and
- Waste shipment.

In the HCW sector, a range of more specific regulatory measures should also be considered. Examples of types of legislation that can be used to regulate the health care waste sector at national level are described in Table 3 below.

Table 3 Typical legislation used to regulate health care waste sector

TYPES OF LEGISLATION	TYPICAL REQUIREMENTS	RELEVANT STAKEHOLDER / ENTRY POINT
Waste duty of care	Full audit trail for waste movements from production to disposal	Ministry of Environment – entry point Organizations involved in the production, transport and disposal of waste
Hazardous waste management	Hazardous waste classification and definitions outlined; Hazardous waste generators required to be registered; Full audit trail for consignment of hazardous waste	Ministry of Environment – entry point Organizations involved in the generation, transport and disposal of hazardous waste
Health care waste management	HCW classification and segregation requirements outlined;	Ministry of Health

[7] Support to Effective Regulatory Systems for Procurement and Supply Management of Health Products, Global Fund, October 2019

	Packaging, storage, treatment and disposal requirements identified	
Permitting, licensing and environmental protection requirements	Facilities that handle, treat and dispose of waste required to be licensed; Minimum requirements for protecting environment from effects of waste activities	Ministry of Environment – entry point Organizations involved in the transfer, treatment and disposal of waste
Medicine and infection control requirements	Requirement for risk assessment and level of control identified	Ministry of Health – entry point Health care facilities
Health and safety in the workplace	Minimum requirement for managing safety in the workplace are outlined; Requirement for risk assessments specified	Ministry of Works / Safety Regulator – entry point Organizations involved in the transfer, treatment and disposal of waste; health care facilities
Hazardous substance handling and classification	Hazardous substances classification and identification defined; Requirements for level of control outlined	Ministry of Works / Safety Regulator – entry point Organizations involved in the generation, collection, transfer, treatment and disposal of waste; health care facilities
Transport of dangerous goods	Appropriate packing, labelling and classification requirements identified; Training requirements specified	Ministry of Transport / Ministry of Works / Safety Executive – entry point Organizations involved in the transport of hazardous waste

National legislation should also define different types of waste and a scheme for waste type classification or refer to an internationally recognized definition or scheme.

Applicants **should identify relevant national legislation** prior to the implementation of health care waste management interventions and **maintain close dialogue with the regulator** to ensure that new waste management measures are introduced compliantly.

The government ministry responsible for the environment would typically be the lead governing entity and/or regulator in establishing, implementing and enforcing legislation in the areas of 'duty of care,' hazardous waste management, and permitting and licensing.

The government ministry responsible for health would typically lead in legislation used to regulate drug and infection control, and the national safety regulator would be expected to support the development and enforcement of legislation on workplace safety and hazardous substance handling. This may also include the production of guidance at national level.

4.2.3.2 Relevant international conventions

A number of international conventions exist which have implications for HCW. Applicants should review the applicability of these conventions to waste management activities planned under Global

Fund grants. Examples of international conventions that have implications for HCW are summarized in Table 4 below.

Table 4 Relevant international conventions which have implications for HCW

CONVENTION	DESCRIPTION
Basel Convention[8]	Aims to protect human health and the environment against the adverse effects from the generation, management, transboundary movement, and disposal of hazardous and other wastes.
Stockholm Convention[9]	Global treaty to protect human health and the environment from highly dangerous, long-lasting chemicals.
Rotterdam Convention[10]	Promotes shared responsibilities and cooperation among parties in international trade of certain hazardous chemicals to protect human health and environment from potential harm.
Bamako Convention[11]	Treaty of African nations prohibiting the import of hazardous waste.
Aarhus Convention[12]	Grants the public rights, and imposes obligations regarding access to information, and public participation and access to environmental justice.
Minamata Convention[13]	Signatory countries to undertake measures to reduce the human and environmental impact of anthropogenic mercury.

4.2.3.3 Preventing illegal activities

A successful waste management system can only be supported by a comprehensive and robust regulatory system that clearly establishes rules and responsibilities, carries out meaningful enforcement and implements measures to deter illegal waste activities. Illegal waste activities can range from littering and illegal dumping to uncontrolled waste processing or operations. In turn, these can lead to the release of uncontrolled emissions that harm the environment.

When implementing HCWM interventions applicants should **identify the duty of care principles that have been enacted at country level** and whether there are any plans in place at national level to introduce additional requirements. This may include assessing whether a system is in place to record HCW movements, the documentation needed to accompany HCW when it is transported and disposed of, and what requirements are in place for the central reporting of HCW data.

4.2.4 Planning and policy

Other factors should be considered to understand how waste management systems can be developed sustainably. This includes establishing and implementing long-term HCW policy, addressing gaps in system capacity, development of an implementation strategy, making financial plans and measuring impact.

[8] http://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx
[9] http://www.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx
[10] http://www.pic.int/TheConvention/Overview/TextoftheConvention/tabid/1048/language/en-US/Default.aspx
[11] https://www.informea.org/en/treaties/bamako/text
[12] https://www.unece.org/env/pp/treatytext.html
[13] http://www.mercuryconvention.org/Convention/Text/tabid/3426/language/en-US/Default.aspx

4.2.4.1 Policy development

The establishment of national waste management policy is fundamental in the long-term development of sustainable waste management practices. Waste management policy is typically set out in a National Waste Management Strategy or Waste Plan which spans a sufficient period of time to facilitate, measure and evaluate policy objectives. This is frequently a period of up to 30 years but, as demonstrated in the example below,[14] may be as short as five years. Policy implementation is usually reviewed at five yearly intervals and monitored with an implementation plan.

Tanzania: National Strategic Plan for Healthcare Waste Management (2018 – 2022)
The United Republic of Tanzania's Ministry of Health, Community Development, Gender, Elderly and Children developed (in partnership with UNDP, GEF, WHO and the World Bank) a national strategic plan to improve HCWM at country level over a five-year period. The plan:

- Sets out relevant national legislation (such as the HIV and AIDs Act, 2008 and Environmental Management Act, 2004) as part of a policy and regulatory framework;
- Identifies key internal (e.g. ministries and departments) and external stakeholders (non-governmental and community-based organizations);
- Establishes the need for national standards and procedures for the minimization, reuse, recycling, segregation, storage, collection, transport, treatment and disposal of HCW to be developed;
- Identifies the organizational structure of HCWM services;
- Has the goal of 'contributing to the improvement of human health and environment through improved HCWM system by 2021' which is underpinned by eight priority areas and strategic objectives ranging from improving HCWM infrastructure and using public private partnerships (PPPs) to capacity building and strengthening of training;
- Is supported by an implementation plan and monitoring indicators for each priority area; and
- Provides budget estimates for strategic objective implementation.

[14] National Strategic Plan for Healthcare Waste Management, Tanzania, 2018

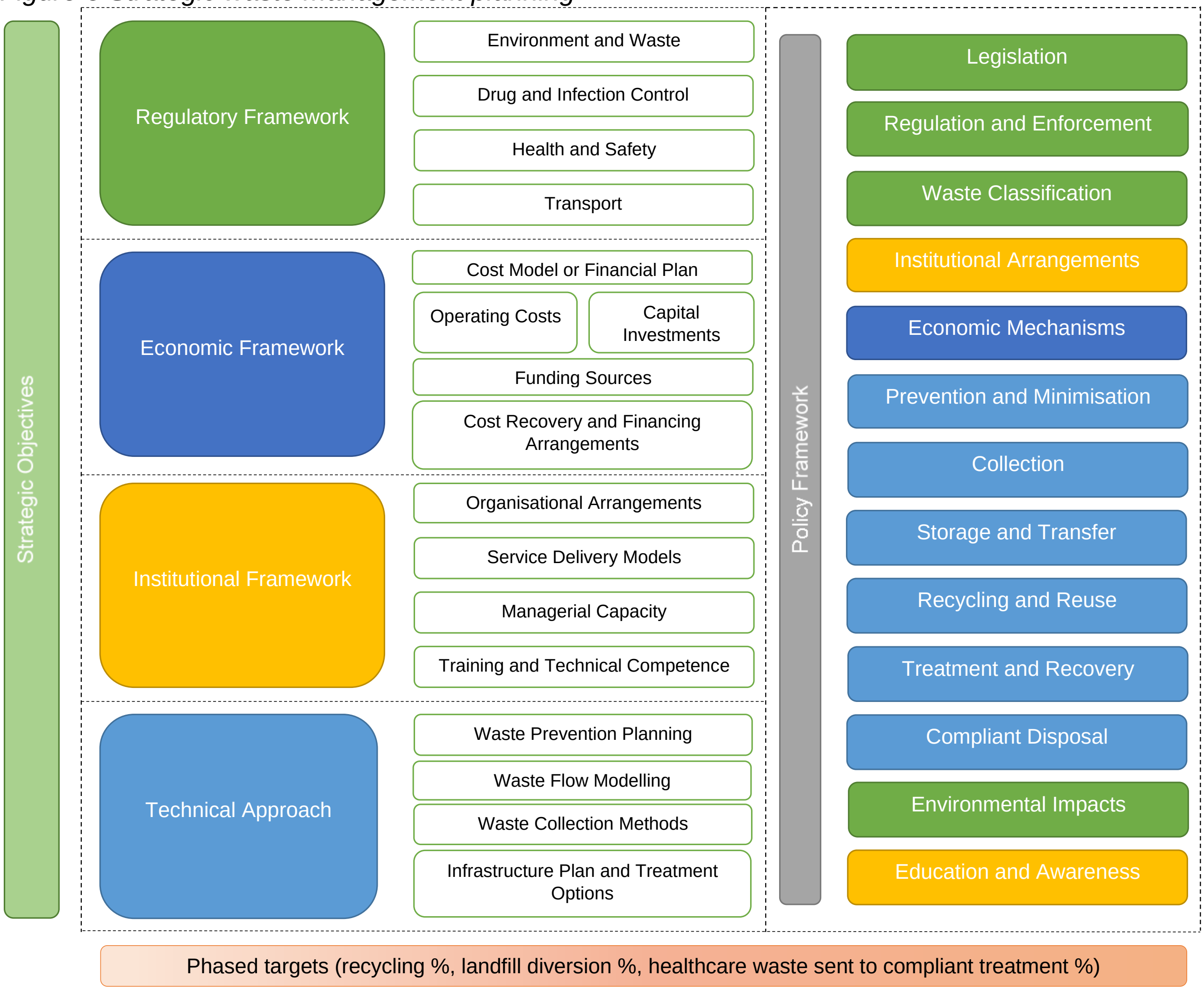
Policy measures are expected to include specific targets to address gaps in the existing waste management system. These may be linked to reducing the environmental burden associated with waste management practices, or by reducing the impact of waste management on society. Examples of health care waste management policy include:

- Establishing targets for the compliant treatment and disposal of HCW;
- Setting timescales for the implementation of at least a basic HCW service at all HCFs;
- Introducing financial tools and incentives to help achieve these targets (such as subsidies or tax relief schemes where HCW is collected and treated compliantly); and
- Introducing enforcement measures for non-compliant or illegal management of HCW.

> Applicants **should identify relevant national level policies** and **ensure that waste management interventions support effective implementation** and growth in the overarching waste management system

An example of how a strategic policy framework can be conceived is illustrated in Figure 3.

Figure 3 Strategic waste management planning



Source: Mott MacDonald

4.2.4.2 Financing and budgeting for waste management

Investment in HCW services may come from a number of sources: public resources, where waste management is well budgeted at national level and resources are readily available; private resources, such as private banks and lenders that seek to achieve a return on investment; or a combinationof these sources .

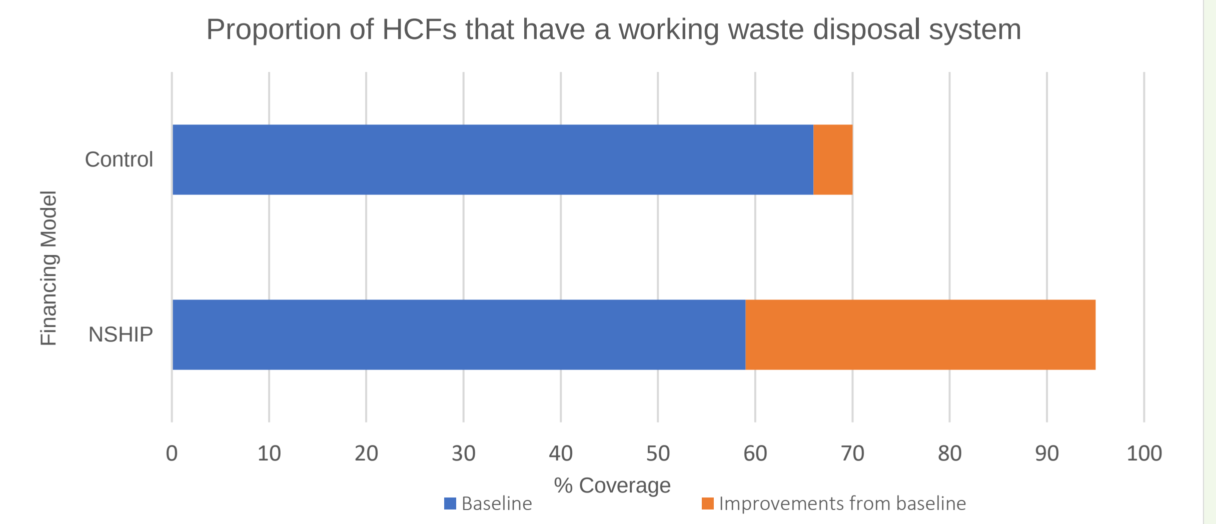
Developing a robust long-term financial plan is essential in supporting HCWM system development. Waste management financial plans should feature the following minimum components:

- Capital investments (e.g. the cost of purchasing waste management equipment and treatment infrastructure);
- Operational expenditure including costs associated with:
  - Staffing;
  - Maintenance (lifecycle, planned and reactive);
  - Training;
  - Disposal (e.g. of residues); and
  - Consumables
- Revenue (e.g. from the sale of recyclables and/or waste derived products); and
- Loan or disbursement repayments (i.e. where funds have been borrowed from lending organisations to support capital investments).

Applicants should **identify other investment and cost recovery opportunities** to support HCWM system sustainability in the long-term (i.e. non-Global Fund financing) which might include matched funding from the public sector or support from other partners. This may also include payments for waste management services by waste generators from the public and private sector where major HCW producers make larger financial contributions to the cost of HCWM services (i.e. in accordance with the **'producer responsibility'** principle).

Best practice: Improving waste management at health care facility level through performance-based financing (PBF)
In 2014 the Government of Nigeria in collaboration with the HRITF and the World Bank launched a performance-based financing (PBF) project called the Nigeria State Health Investment Project (NSHIP). PBFs provide funding directly to HCFs based on the quantity and quality of services they deliver. The prime objective was "to increase the delivery and use of high impact maternal and child health interventions and to improve the quality of care at selected health facilities in the participating states". Baseline and output data was collected among others through health facility assessment, including data on waste management. A comparison of the impact of the NSHIP PBF on waste disposal coverage is provided below in Figure 4.

Figure 4: Graph to illustrate impact of NSHIP PBF on waste disposal coverage



Source: Adapted from Impact Evaluation of Nigeria State Health Investment Project, 2014

4.2.5 Risk profiling health products

Health products risk profiling supports the understanding of the types of waste management interventions that may be applicable to help mitigate environmental and human health impact of waste generated from Global Fund financed health products.

Applicants are encouraged to assess the potential risk presented by Global Fund sourced health products and introduce relevant waste management interventions to control or mitigate such risks. Table 4 identifies the parameters and considerations that grant applicants should assess.

Table 4 Health product risk profile considerations

PARAMETER	RISK ASSESSMENT	KEY CONSIDERATIONS
Classification	This refers to the risk related to the correct classification of the product. If a product is misclassified, it is likely to be disposed of improperly, increasing the potential for human and environmental harm. Should be determined based on: • How simple the waste is to categorize; and • Whether it will easily fit into a single waste class, such as chemical, pharmaceutical, or infectious.	For example, there may be less risk of misclassification from a pharmaceutical drug issued directly in clinics than a product which spans multiple waste classifications and is distributed directly to the public.
Segregation	Similar to 'Classification' but covers the practical aspect of waste handling and segregation. Should be determined based on how easy the item is to identify and store.	For example, there may be less risk of a reagent used in only a controlled environment (e.g. a lab) being incorrectly segregated than an unlabeled or non-identifiable product that is distributed directly to the public.
Collection	The risk of a product being difficult or hazardous to physically handle. For instance, sharps waste, radioactive waste, infectious waste, and chemical waste can pose significant immediate hazards if handled without the correct protective equipment.	For example, labelled, expired non-hazardous drugs contained in safe packaging are likely to pose a lower handling risk than highly infectious waste, sharps waste and radioactive waste.
Transport	Related to the likelihood of a hazard occurring during transport after the waste has been collected from the waste collection point (e.g. a HCF), which may include damage to the waste within the collection vehicle or in the event of waste escaping from the vehicle during transport (e.g. due to unsecure loads or traffic accidents).	Most products are unlikely to physically or chemically alter during transportation, in a way which causes a hazard to manifest. Exceptions include products containing glass (such as drug vials / ampoules) which may shatter, or items which require special storage to prevent a hazard (for instance a reagent which may ignite if transported improperly (or in a hot vehicle).

Treatment, recovery and disposal	This refers to the difficulty, impact, and hazard associated with processing the product for final disposal or recycling.	For example, products that are safe to landfill or can be recycled are likely to pose a low risk whereas those that require chemical inactivation or need to be sent to a hazardous landfill would be likely to present a higher risk.
Environmental impact	This refers to the danger posed to the natural environment by the waste being released without treatment or control. This includes hazards posed to wildlife, soils, and aquatic life.	For example, a product that does not contain any hazardous substances is likely to be of lower risk to the environment than contains hazardous and highly toxic substances.
Effects on human health	This should assess how hazardous a product is to human health if it is disposed of improperly.	For example, a product that contains no hazardous substances is likely to pose a lower risk to the environment than a product that contains acutely toxic substances.

Further information on the approach to assessing health product risk is summarized within the UNDP and Healthcare Without Harm (HCWH) list of chemicals of concern[15] and the environmentally persistent pharmaceutical pollutants within the Strategic Approach to International Chemicals Management (SAICM)[16] program.

When assessing the level of risk applicants should **look at the product packaging and any included information such as the patient safety information** or in some cases, the Safety Data Sheets (SDSs), and any identified warnings (hazard symbols) in accordance with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

4.2.6 Measurement

Capacity planning at national level should be supported by robust data. Applicants may wish to establish HCW coverage at health facility level by carrying out a health care facility assessment in accordance with the Water and Sanitation for Health Facility Improvement Tool (WASH FIT)17, developed by WHO and UNICEF. The tool can be used to assess a HCF in accordance with national and global standards to identify the basis for making necessary improvements. Data gathered on this basis helps to identify service level based on the extent to which waste is safely segregated (for example, into at least three clearly labelled bins) and safely treated and disposed of (using methods such as incineration, autoclaving, and burial in a lined, protected pit).

[15] Chemicals of Concern to Health and the Environment, UNCP/HCWH, 2018
[16] http://www.saicm.org/Implementation/EmergingPolicyIssues/PharmaceuticalPollutants/tabid/5477/language/en-US/Default.aspx
[17] https://apps.who.int/iris/bitstream/handle/10665/254910/9789241511698-eng.pdf;jsessionid=E47FD8BC3709D9DB5715D710EA91E1DF?sequence=1

5. Best practices in waste management

5.1 What is good waste management?

This section provides a brief summary of the technical considerations of best practices in HCW management. Complimentary guidance on specific approaches for the management of waste from a range of health products is included in Appendix A.

> Applicants are encouraged to **develop waste management interventions that support or provide a catalyst for a systems approach**. This may include implementing measures that address **a single component** of the HCW management system **or those that address many components of the system**.

5.2 Avoidance, reduction, and minimization

Unfortunately, some amount of waste generation is unavoidable. Wherever a waste stream cannot be eliminated completely, it should be minimized as much as possible.

Many of the most effective measures to eliminate or minimize waste streams in health care are applicable at the manufacturing, supply, and import stages of the supply chain. These include: reducing product packaging; reducing shipping waste; and modifying the design of health care products themselves to utilize less material or to dispose of them in an easier way.

Assessing health product demand and use is fundamental in reducing over-supply and / or reducing the impact of product expiry, thus minimizing the potential for waste generation.

This is particularly important for health products with an explicit expiry date or short useful life (e.g. antiretrovirals and artemisinin combination therapies (ACT) drugs which could lead to the production of excessive quantities of pharmaceutical and packaging waste types).

> Applicants should **ensure that a considered and methodical approach is taken towards health product forecasting**, prior to the point of procurement and in consideration of the types of HCW likely to be produced.

Example methods for eliminating waste may include:

- Switching from analogue to digital X-ray systems to eliminate the stream of hazardous fixer, developer, and film;
- Switching from single use items (such as paper cups, or disposable thermometer covers) to reusable equivalents (glass or ceramic cups, or washable thermometer probes);
- Avoiding unnecessary tests, procedures, and other actions that generate waste (this could be achieved by improving record keeping and management practices to make sure tests / procedures are not repeated unnecessarily); and
- Emplacing a procurement policy which explicitly precludes purchasing products that contain toxic materials such as mercury, PVC or glutaraldehyde; and setting progressive targets for those which cannot yet be eliminated.

Example methods for minimizing waste may include:

- Reducing the amount of packaging used to ship or transport products (for instance switching to bulk packaging for LLINs); switching from cartonless bottles of ARVs*[1] or using multi-month packs;
- Switching to recyclable or otherwise less harmful goods where possible*[2];
- Utilizing 'just in time' procurement for goods, to avoid over-purchasing (leading to medicines expiring, or products being unnecessarily thrown away);
- Implementing inventory control systems and wastage indicator to be reported to track health care products and pharmaceuticals in order to limit item loss and expiration

*[1]https://www.theglobalfund.org/media/8126/psm_cartonlesspackagingforarvtreatments_report_en.pdf?u=637044314350000000

*[2]Recycable materials used for containing hazardous substances (e.g. plastic or glass bottles) should not be recycled because they pose a risk of contamination to new products.

5.3 Waste auditing and composition studies

Waste auditing and composition studies are fundamental in establishing the need for waste management interventions. They help to determine how much waste is being generated, where it is being generated and the types of waste being produced. This can then be used to inform future HCW planning and decision making. Applicants should therefore encourage waste audit and composition study interventions at health facility level to help support the gathering of baseline data and HCW system development. Detailed guidance on assessing HCF waste generation is included in the WHO Blue Book.[18]

5.4 Classification

A full list of typical HCW categories are set out in WHO guidance[19]. Specific examples of how wastes from health products may be categorized is provided in Appendix A of this brief.

5.5 Source segregation

Proper segregation of HCW at (or near) to the point of production is one of the most essential factors in safe, sustainable waste management.

It is recommended that bins should be provided in all locations where HCW may be generated to segregate at least the following categories:

- Sharps bins and needle/hub cutters
  - For used needles from blood tests and injections;
  - Cutting the hubs and needles from syringes prevents needle stick injuries and illicit reuse of syringes
- High-risk waste bins
  - For use with infectious waste (such as cultures and swabs from infected patients);
  - High-risk pharmaceutical waste (such as expired Efavirenz / Emtricitabine / Tenofovir);
- Low-risk waste bins
  - For pathological waste (including samples and swabs from non-infected patients);
  - Low-risk pharmaceutical waste (such as expired Amikacin solution); and
- General waste bins (for MSW and recyclable waste).

[18] Safe management of wastes from healthcare facilities, second edition, WHO, 2014
[19] Safe management of wastes from healthcare activities: A summary, WHO, 2017

5.6 Storage and handling

All HCW storage areas must have enough capacity to hold the waste generated until it can be disposed of properly. This will depend on the waste generation rate of individual health facilities as well as the frequency of collection and disposal.

Storage areas must be large enough so they do not overflow and separate spaces must be provided for different types of waste.

All HCW storage areas should be well signed, dry, and secure from unauthorized persons, pests and disease vectors. Staff must be trained to use storage areas for them to be effective. More information is given in the WHO Blue Book.

5.7 Transfer and transport

The method used to transport HCW should be appropriate to the individual circumstances of health facilities and compliant with national transport regulations. Non-hazardous and hazardous waste should not be moved together. Separate vehicles are required for each and hazardous waste transportation should be in line with ADR.

If it is well segregated, the waste generated at an HCF is around 80% non-hazardous. Therefore, it may be necessary to schedule more collections for non-hazardous waste than hazardous.

5.8 Treatment and disposal

When planning waste management interventions applicants should consider the most suitable form of waste treatment and disposal, which will be subject to the types of HCW generated, an adequate level of source segregation, national regulation and local conditions (environmental, social, financial).

5.8.1 Waste treatment options

Table 6 below summarizes the most common methods of HCW treatment.

Table 6 Summary of HCW treatment options

TREATMENT TYPE	TECHNOLOGY	DESCRIPTION
Low heat	Autoclaving	Use a combination of steam, heat, and pressure to disinfect waste and medical equipment. Widely used and come in a variety of sizes and configurations. For further information, see the ICRC[20] and CDC[21] guidelines.
	Microwaving	One of the most recent developments in the field of HCW treatment. Should not be used on waste that may contain metal items such as surgical implements. Can operate in two ways: • Batch-wise - meaning a sample of waste is inserted, thermally treated, and then removed before another batch is processed; or • Continuous - where waste moves through an automated system.

[20] Sterilization Guidelines, ICRC, 2014
[21] https://www.cdc.gov/infectioncontrol/guidelines/disinfection/sterilization/steam.html

	Dry heating	Use hot air (below incineration temperature) without the addition of moisture to disinfect waste and equipment. For further information please see UNEP guidance[22].
	Friction heating	Use a high-speed shredder to destroy waste while generating heat. Additional heat is provided by resistance heaters. For further information please see UNEP guidance.
Chemical processes	Sodium hypochlorite treatment	Commonly known as bleach, or just “hypochlorite” - is widely used substance for cleaning and chemical disinfection due to its oxidizing properties. For more information, see the WHO technologies guidance
High heat	De Montfort incinerators	A range of small-scale incinerators designed to treat clinical waste in the developing world. Relatively simple incinerators with no environmental safeguards, intended for emergency settings only. If a more sophisticated, less polluting option is available, it is preferable to a small-scale incinerator without flue-gas treatment.
	Dual chamber incinerators	Burn waste in the primary combustion chamber at or above 850°C. Multiple oil or gas burners maintain the temperature in the primary chamber. Vapors produced in the primary chamber are directed into a secondary chamber which has one or more burners to bring the temperature to above 1100 °C required to treat HCW. Flue gas treatment is recommended to reduce air pollution and may be required by the relevant national legislation.
	Co-incineration	Co-incineration is the practice of incinerating clinical waste alongside other waste streams in municipal incinerators. This usually means finding an existing local municipal incinerator. Municipal incinerators generally do not burn hot enough to fully disinfect clinical waste. Cement kilns, and iron forges are generally the only existing incineration facilities that reach sufficient temperatures to incinerate clinical waste safely. Co-incineration is common in some industrialized countries, but is not recommended under Stockholm Convention guidelines, so if a more suitable solution (autoclaving or otherwise) is available, it should be given priority.

Further information on HCW treatment technologies can be found in the UNEP/IETC compendium, module 15 of the GEF / UNDP Global Healthcare Waste Project[23], and in the WHO guidance on technologies for the treatment of infectious and sharp waste from HCFs.[24]

5.8.2 Off-site treatment

Off-site treatment and disposal typically requires the transfer of HCW to a private contractor, government entity, or the informal sector and is subject to the availability of third-party operated HCW treatment and/or disposal infrastructure. It is important to make sure the organization transporting the waste off-site is treating and disposing of it properly, to avoid environmental contamination, damage to human health and potential legal liability. This may include checking that the organization is certified and has the appropriate equipment to transport HCW.

[22] Compendium of Technologies for Treatment/Destruction of Healthcare Waste, UNEP, 2012
[23] MODULE 15: Non-Incineration Treatment and Disposal of Healthcare Waste, GEF/UNDP
[24] Overview of technologies for the treatment of infectious and sharp waste from health care facilities, WHO, 2019

6. Further guidance

WHO

Safe management of wastes from health-care activities (2014)

Safe management of wastes from health-care activities: A summary (2017)

WHO modules of healthcare waste management

Overview of technologies for the treatment of infectious and sharp waste from health care facilities (2019)

United Nations Environment Programme (UNEP)

Compendium of Technologies for Treatment/Destruction of Healthcare Waste (2012)

Red Cross

Medical Waste Management (2011)

Sterilization Guidelines (2014)

United States Agency for International Development (USAID)

Sector Environmental Guidelines- Healthcare Waste (2015)

Centers for Disease Control and Prevention (CDC)

Infection Control Guidelines

Global Environment Fund (GEF) / UNDP

Technical Specifications for Healthcare Waste Management Equipment (2019)

European Medicines Agency (EMEA)

Guideline on the Environmental Risk Assessment of Medicinal Products for Human Use (2006)

7. Appendix A

Table A1 Waste categories and management approaches

HEALTH CARE WASTE CATEGORY	ASSOCIATED DISEASE	HEALTH PRODUCT DESCRIPTION	WASTE MANAGEMENT APPROACHES
Infectious waste	All	Waste contaminated with blood and other bodily fluids (e.g. from discarded diagnostic samples), cultures and stocks of infectious agents from laboratory work (e.g. waste from autopsies and infected animals from laboratories), or waste from patients with infections (e.g. swabs, bandages and disposable medical devices)	Infectious waste can be incinerated, or can be treated using: Thermal; Chemical; Biological; and/or Irradiative techniques Treated wastes can then be disposed of in an approved, engineered landfill. Autoclaving is the most widely practiced method of infectious waste treatment where it is available. Other thermal waste treatment options include microwaving, electrothermal disinfection, frictional heating, and dry heating. Chemical disinfectants are widely used, but usually result in the emission of persistent pollutants. Biological and irradiative methods are not widely commercially available, or commonly used.
	All	Used surgical and face masks	Can be treated with low-temperature thermal methods, including autoclaving, microwaving, and friction heating, before final disposal. Masks should not be reused.
	All	Used gloves	Latex / nitrile gloves should never be reused. Gloves used in patient treatment areas should be disposed of with other infectious waste. Gloves used in labs which may have come into contact with hazardous chemicals should be treated as chemical waste.
	All	Contaminated cleaning supplies	Can be treated with low-temperature thermal methods, including autoclaving, microwaving, and friction heating, before final disposal.

HEALTH CARE WASTE CATEGORY	ASSOCIATED DISEASE	HEALTH PRODUCT DESCRIPTION	WASTE MANAGEMENT APPROACHES
	HIV / AIDS	Condoms and tampons	These are distributed for off-premises use and will likely end up mixed with MSW in household / public bins. This is not considered a significant danger due to the low level of infection risk.
	TB	Liquid media with supplements (including BD Bactec MGIT tubes and supplement kits, BD Bactec PZA tubes and kits, and BD Taxo test strips)	Can be treated with low-temperature thermal methods, including autoclaving, microwaving, and friction heating, before final disposal. Chemical treatment can also be suitable.
	TB	Consumables for LPA testing	Can be treated with low-temperature thermal methods, including autoclaving, microwaving, and friction heating, before final disposal. Chemical treatment can also be suitable.
	TB	Sputum containers, slides for microscopy, applicators, and filter paper	Infectious items can be treated with low-temperature thermal methods. Some items may be safe for reuse (see manufacturer recommendations and local legislation).
	Malaria / HIV / AIDS	Rapid diagnostic tests, microscopy supplies	Infectious items can be treated with low-temperature thermal or chemical methods. Some microscopy supplies may be safe for reuse (see manufacturer recommendations and local legislation).
Infectious / Chemical	All	Pipettes and lab tubes, bottles, vials, beakers, and, viral load kits diagnostic products	Infectious items can be treated with low-temperature thermal methods. Chemically contaminated items may be safe to rinse (for small amounts of low-hazard chemical contamination) and reused.
Infectious / Chemical waste	Malaria	Protective clothing	Should not be reused beyond manufacturers recommendations and should be removed from service when it becomes unsafe to use (obvious holes, or other significant wear). Protective clothing should be incinerated at HTI when it is ready for disposal.
Pathological waste		Human tissues, organs or fluids, and body parts	Wastes of this type must be either buried or incinerated. Lab cultured pathological wastes should be autoclaved in the lab before disposal. Pathological wastes are often disposed of using the same channels as dead bodies (either incinerated, or buried), and in a health care setting are often handled by the same contractor / department responsible for those. Local culture also has an impact on disposal. In some areas of the world, certain pathological waste, such as placentas must be treated in a culturally appropriate fashion (for instance, placentas being taken home by the mother for home-burial). Some pathological wastes have been biodigested using Anaerobic Digestion (AD) technology.

HEALTH CARE WASTE CATEGORY	ASSOCIATED DISEASE	HEALTH PRODUCT DESCRIPTION	WASTE MANAGEMENT APPROACHES
	TB	Biochemical tests for patients on the 2nd line treatment, including: Serum creatinine, serum potassium, thyroid-stimulating hormone, aspartate aminotransferase (AST), alanine aminotransferase (ALT)	If possible, these wastes should be treated in the lab (with low-temperature thermal or chemical methods), before final disposal (sanitary landfill, or HTI before landfilling).
Sharps waste	All	Syringes, needles, disposable scalpels and blades	Sharps waste is one of the most dangerous streams to handle due to the high risk of Needle Stick Injuries (NSIs), which can spread serious diseases. This waste stream requires the use of secure, rigid, and impenetrable storage bins (ideally colour coded, with a secure one-way needle deposition system). Staff handling sharps waste should be equipped with NSI preventative PPE.
	All	Needles for clinical use	Sharps bins are essential for the adequate management of sharps waste. Needle destruction devices are recommended to minimize the amount of sharps waste that must be handled. Needles should never be reused. Suitable methods for sharps waste treatment include low-heat thermal processes, chemical methods, and high-temperature incineration. In resource poor situations, sharps can be disposed of in a purpose-built sharps-pit.
	HIV / AIDS	Needles for off-site use	These are distributed by some programs to reduce the risk of infection through contaminated needles. Often managed through needle exchange programs.
Chemical waste	All	Solvents and reagents used for laboratory preparations, disinfectants, sterilants and heavy metals contained in medical devices (e.g. mercury in broken thermometers) and batteries	The health care implications of chemical waste depend on its nature. Less hazardous chemical wastes may be diluted and disposed of using sewage / wastewater drains in countries where there is adequate infrastructure (if allowed by local legislation). Larger quantities and more hazardous chemical wastes will require more advanced treatment. Where possible, chemical wastes should be returned to the supplier, or passed on to a licensed contractor, or suitable government body for disposal. Hazardous chemical wastes of different composition should be stored separately to avoid unwanted chemical reactions;

HEALTH CARE WASTE CATEGORY	ASSOCIATED DISEASE	HEALTH PRODUCT DESCRIPTION	WASTE MANAGEMENT APPROACHES
			Hazardous chemical waste should not be discharged into sewerage systems; Large amounts of chemical waste should not be buried, because they may leak from their containers, overwhelm the natural attenuation process provided by the surrounding waste and soils, and contaminate water sources; Large amounts of chemical disinfectants should not be encapsulated, because they are corrosive to concrete and sometimes produce flammable gases.
	All	Laboratory cleaning supplies	Wastes will depend on nature of supplies / cleaning. Recognised standards for lab cleaning exist, such as ASTM D5245 - 19[25].
	TB	Consumables for LPA testing	Small quantities of less hazardous chemical waste can be diluted and disposed of via the wastewater system (if a robust wastewater treatment system exists in the region / country), subject to local guidelines and regulations. Larger quantities and more hazardous substances should be collected for handoff to a specialist contractor or government entity.
	TB	Lab reagents	Small quantities of less hazardous chemical waste can be diluted and disposed of via the wastewater system (if a robust wastewater treatment system exists that does not drain or leach into the watercourse). Larger quantities and more hazardous substances should be collected for handoff to a specialist contractor or government entity.
	TB	Immersion oil, carbon fuchsine, methylene blue, phenol detached crystals, and sodium hypochlorite.	Small quantities of less hazardous chemical waste can be diluted and disposed of via the wastewater system (if a robust wastewater treatment system exists in the region / country). Larger quantities and more hazardous substances should be collected for handoff to a specialist contractor or government entity.
	TB	X-ray fixer	Contains hazardous levels of silver. Should be handled with extreme care. Recovery of this silver is difficult, and not widely practiced.
	Malaria	Pyrethroids	Small quantities of less hazardous chemical waste can be diluted and disposed of via the wastewater system (if a robust wastewater treatment system exists in the region / country). Larger quantities and more

[25] https://www.astm.org/Standards/D5245.htm

HEALTH CARE WASTE CATEGORY	ASSOCIATED DISEASE	HEALTH PRODUCT DESCRIPTION	WASTE MANAGEMENT APPROACHES
			hazardous substances should be collected for handoff to a specialist contractor or government entity.
	Malaria	Insecticide spray pumps	Typically treated using soak-pits.
Chemical / Recyclable waste	TB	X-ray film	Contains high levels of silver. Can potentially be hazardous to handle, but the concentration is usually not high enough to be dangerous without long-term exposure. Can be recycled profitably due to high precious metal content
Chemical / Infectious	TB	Lab reagents from culturing and drug susceptibility testing	Small quantities of less hazardous chemical waste can be diluted and disposed of via the wastewater system (if a robust wastewater treatment system exists in the region / country). Larger quantities and more hazardous substances should be collected for handoff to a specialist contractor or government entity.
Chemical / Recyclable waste	Malaria	Long-Lasting Insect Nets (LLINs)	The WHO advises that LLINs (even those with holes) continue to be used past expiry unless a replacement is available, as they remain effective to some degree. HTI (i.e. >1100ºc). These nets are made of high strength plastic (typically polyethylene). This makes it possible to recycle them in countries with the necessary infrastructure. Some reuse is possible (as window screens, curtains, etc). Reuse outdoors, or in applications where there is a risk of human contact (as clothing or washing equipment) should be avoided. Incineration recommended for final disposal. Contaminated plastic packaging (i.e. plastic film and wrappings directly in contact with LLINs) should be classified as chemical waste and sent for HTI. Non-contaminated plastic packaging should be segregated and may be sent for recycling where markets exist.
Pharmaceutical waste	All / general	Expired, unused and contaminated drugs and vaccines	As with chemical waste, the properties of pharmaceutical waste can vary significantly. Ideally hospitals should avoid allowing pharmaceutical products to expire, by using “just in time” procurement. Where expired drugs are

HEALTH CARE WASTE CATEGORY	ASSOCIATED DISEASE	HEALTH PRODUCT DESCRIPTION	WASTE MANAGEMENT APPROACHES
			unavoidable, HCF managers should aim to establish take-back systems with their suppliers. When this cannot be achieved, they should be passed on to specialist contractors, or government entities, as with chemical waste. Cheap and easily obtained chemicals can neutralize specific drugs, particularly chemotherapeutic agents. Many are listed in the Annexes of the WHO Guidelines on the Safe Management of Wastes from Healthcare Facilities. These are particularly useful for small amounts of liquid residues, for example in IV sets.
	TB	First and second line anti-TB medications	To be returned to manufacturer for disposal if possible. If return is impossible, specialist disposal contractors can be sought. At minimum this waste stream should be disposed of in a high-temperature incinerator (unless otherwise specified in manufacturers disposal instructions)
	Malaria	Expired / unused malaria medications	To be returned to manufacturer for disposal if possible. If return is impossible, specialist disposal contractors can be sought. At minimum this waste stream should be disposed of in a high-temperature incinerator (unless otherwise specified in manufacturers disposal instructions)
Cytotoxic waste	All	Waste containing substances with genotoxic properties (i.e. highly hazardous substances that are, mutagenic, teratogenic or carcinogenic), such as cytotoxic drugs used in cancer treatment and their metabolites	Cytotoxic waste is highly hazardous and should never be landfilled or discharged into the sewerage system. Disposal options include: Return to the original supplier; Incineration at high temperatures; Chemical degradation in accordance with manufacturers' instructions. Full destruction of all cytotoxic substances may require incineration temperatures up to 1200 °C and a minimum gas residence time of two seconds in the second chamber. The incinerator should be equipped with gas-cleaning equipment. Incineration at lower temperatures may release hazardous cytotoxic vapours into the atmosphere. Incineration in most municipal mass burn incinerators (i.e. <1100^{o}c), in single-chamber incinerators or by open-air burning, is inappropriate for the disposal of cytotoxic waste.
Radioactive waste	TB	Products contaminated by radionuclides including	The treatment and disposal of radioactive waste is generally under the jurisdiction of a nuclear regulatory agency. Facilities producing

HEALTH CARE WASTE CATEGORY	ASSOCIATED DISEASE	HEALTH PRODUCT DESCRIPTION	WASTE MANAGEMENT APPROACHES
		radioactive diagnostic material or radiotherapeutic materials	radioactive waste should have a radioactive waste management plan in place and should have arrangements approved by the local nuclear body if possible. Three disposal methods are possible for low-level radioactive waste: “Decay in storage”, which is the safe storage of waste until its radiation levels are indistinguishable from background radiation; a general rule is to store the waste for at least 10 times the half-life of the longest-lived radionuclide in the waste; Return to supplier; Long-term storage at an authorized radioactive waste disposal site. Long-lived radionucleotides, sealed sources, and spent sources (such as end-of-life x-ray equipment) should be returned to the supplier when possible.
WEEE / Radioactive waste	TB	Mobile digital x-ray equipment	If possible, should be returned to manufacturer for refurbishment, or specialist deconstruction and recycling.
Non-Health Care Waste Categories			
Municipal Solid Waste (MSW)	All	General waste of the type produced by households. Often consists of food scraps (where not processed as a separate waste stream), non-recyclable plastics, packaging, non-infectious textiles, and small amounts of inorganic materials, such as stone.	Generally handled by a local government authority. In areas where government authorities are unable to provide adequate general waste management, a general waste contractor may be appointed to collect and dispose of MSW. Typically, MSW may be incinerated, landfilled, or sent to a materials recovery facility to have any recyclable content sorted from it.
	All	Non-contaminated cleaning supplies	Can be disposed of in main bins with other MSW
Recyclable waste	All	Items such as non-infectious / non-chemically contaminated glass, plastics, and metals.	In many places collected by a local government authority, or general waste contractor. May potentially be sold for a profit in some areas (where there is a market for recyclable materials).
Paper / cardboard waste	All	Non-contaminated paper and cardboard. Recyclable in most areas.	In many places collected by a local government authority, or general waste contractor. May potentially be sold for a profit in some areas (where there is a market for recyclable materials).

HEALTH CARE WASTE CATEGORY	ASSOCIATED DISEASE	HEALTH PRODUCT DESCRIPTION	WASTE MANAGEMENT APPROACHES
	All	Stationary / printed materials	Commonly recycled at municipal scale. Should be kept separate from non-recyclable wastes to avoid cross-contamination.
WEEE (Waste Electrical and Electronic Equipment)	All	All electronics, and electrical equipment (except for radioactive items such as x-ray machinery).	Electronics can be hazardous to the environment and should be returned to the manufacturer for disposal / recycling where possible (as in the case of certain medical / laboratory electronics) or handed off to a designated government agency or specialist contractor. Much of the world lacks access to environmentally friendly and safe WEEE disposal. WEEE specialist recyclers do exist in some countries however. If feasible, WEEE should be exported to such a specialist. Simpler / non-laboratory WEEE can be repaired and / or donated (for instance in the case of outdated IT equipment).
	All	IT equipment	Can often be repaired, or have components replaced. Items damaged beyond potential reuse should be stored and handed off to a government backed WEEE recycling programme, or specialist recycler, if possible.
	TB	Coagulators, centrifuges, and audiometry equipment	If possible, should be returned to manufacturer for refurbishment, or specialist deconstruction and recycling.
WEEE / Recyclable waste	TB	Microscopes	If possible, should be returned to manufacturer for refurbishment, or specialist deconstruction and recycling. Simple microscopes should be safe to sell from scrap / local recycling.
WEEE / Bulky waste	TB	Bio-safety cabinets, refrigerators	If possible, should be returned to manufacturer for refurbishment, or specialist deconstruction and recycling.
WEEE / Infectious waste	TB	Autoclaves	If possible, should be returned to manufacturer for refurbishment, or specialist deconstruction and recycling.
WEEE / Radioactive waste	TB	Mobile digital x-ray equipment	If possible, should be returned to manufacturer for refurbishment, or specialist deconstruction and recycling.
Bulky waste	All	Large items of furniture and WEEE (except for radioactive items such as x-ray machinery)	May potentially be repairable or recyclable. Depends on the nature of the item. Bulky waste items are typically too large to be stored in bins, so should be kept uncontained in a secure area where possible.