

worm

Waste in humanitarian Operations:
Reduction and Minimisation

D5.3. Medical Waste Management Guidelines - Policy Brief

Date of delivery: **27/06/2025**

Author(s): **Yumiko ABE-SOULIER, Sébastien
Soulier**

Institution: **Solvoz, the Netherlands**



**Funded by the
European Union**

Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

DOCUMENT TRACK INFORMATION

PROJECT INFORMATION	
Project acronym	WORM
Project title	Waste in humanitarian Operations: Reduction and Minimisation
Starting date	01/01/2024
Duration	24 months
Call identifier	HORIZON-CL6-2023-CIRCBIO-01
Grant Agreement No	101135392

DELIVERABLE INFORMATION	
Deliverable number	D5.3
Work Package number	WP5
Deliverable title	Medical waste management guidelines - policy brief
Authors	Yumiko Abe-Soulier (Solvos) Sébastien Soulier (Solvos)
Due date	30/06/2025
Submission date	27/06/2025
Type of deliverable	R
Dissemination level	PU

REVISION TABLE

VERSION	CONTRIBUTORS	DATE	DESCRIPTION
V0.1	Yumiko Abe (Solvoy)	01/06/2025	First draft
V0.2	Sébastien Soulier (Solvoy)	03/06/2025	Updated draft internally reviewed
V0.3	Yumiko Abe (Solvoy)	06/06/2025	Updated draft after contribution
V0.4	Ville Juusela (FRC), Waqar Ahmad (IMC)	26-27/06/2025	Edits and contributions
V0.5	Sarah Bonnet (EURO)	26/06/2025	Formatting
V0.6	Yumiko Abe (Solvoy)	27/06/2025	Final edits
V1	Gyöngyi Kovács (Hanken)	27/06/2025	Final version for submission

LIST OF ACRONYMS

ACRONYM	FULL NAME
EC	European Commission
EMT	Emergency medical team(s)
IWM	Integral waste management
MSW	Municipal solid waste
PPE	Personal protective equipment
WASH	Water, sanitation, and hygiene
WPs	Work package(s)



TABLE OF CONTENT

LIST OF ACRONYMS	3
LIST OF TABLES	5
BACKGROUND ABOUT WORM	6
EXECUTIVE SUMMARY.....	6
NON-TECHNICAL SUMMARY	7
PREFACE.....	8
1. INTRODUCTION	9
1.1 Integral waste management.....	9
1.2 Three phases of integral waste management	10
1.3 Waste reduction recommendations.....	10
2. PLANNING - PRE-DEPLOYMENT PHASE: DEFINE, ANTICIPATE, PLAN	12
2.1 Define waste profile.....	12
2.2 Anticipate constraints	14
2.3 Identify and assess existing local systems	14
2.4 Draft the waste management plan.....	14
2.5 Waste management kit.....	16
3. PREPARATION - SETUP PHASE: BUILD, TRAIN, ACTIVATE	17
4. EXECUTION - OPERATIONAL PHASE: RUN, MONITOR, ADAPT.....	18
5. CONCLUSION AND RECOMMENDATIONS.....	21
5.1 Final Recommendations	22
REFERENCES.....	23
ANNEX 1.....	24
ANNEX 2.....	26
ANNEX 3.....	28
ANNEX 4.....	29
ANNEX 5.....	34
ANNEX 6.....	36
ANNEX 7 SEGREGATION PROMOTION POSTERS	38
ANNEX 8 PROTECT YOURSELF POSTERS	43
ANNEX 9 WASTE COLLECTION AND TRANSPORT WITHIN A FIELD HOSPITAL.....	45
ANNEX 10 HANDLING AND DISPOSAL OF LIQUID BODY FLUIDS FROM CONTAINERS...	47
ANNEX 11 WASTE MANAGEMENT KIT	49
ANNEX 12 WASTE BIN PLACEMENT STRATEGY	50

LIST OF TABLES

Table 1: Waste streams and color-coding system	13
Table 2: Results from waste generation survey in Tanzania	14
Table 3: Recommended on-site treatment and disposal methods	16



BACKGROUND ABOUT WORM

WORM aims to design guidelines and support actions for circular economy in the humanitarian sector. It integrates bio-based technological solutions, leverages procurement for waste reduction, improves waste management methods and priorities the sustainable livelihoods of waste pickers. WORM focuses on two selected settings: field hospital deployments and humanitarian livelihood programmes with a waste picking component. Following a collaborative and multi-actor approach, WORM brings together medical and humanitarian organisations, procurement service providers, logistics providers, waste management services and academic partners.

EXECUTIVE SUMMARY

This document is a deliverable of the WORM Project, funded under the European Union's Horizon Europe research and innovation programme under the grant agreement No 101135392. The WORM WP5 Guidelines offer a comprehensive framework for improving waste management in humanitarian field hospitals by embedding sustainability and operational coherence into emergency medical missions. Developed under the Horizon Europe-funded WORM project, the guidelines advocate for an Integral Waste Management (IWM) approach that aligns waste reduction, risk mitigation, and environmental stewardship with core humanitarian principles.

The document emphasizes that waste management should not be treated as an isolated technical task but as a shared responsibility integrated across all functional areas—from procurement and logistics to clinical care and WASH (water, sanitation, and hygiene). Field hospitals, especially in conflict or post-disaster zones, generate significant amounts of waste, including hazardous medical waste, in settings with minimal or non-existent infrastructure. Improper handling, such as mixing infectious and non-infectious waste, leads to elevated health risks and environmental harm.

To address this, WORM outlines a three-phase model:

1. **Planning** involves estimating waste types and quantities, anticipating local constraints, mapping local waste infrastructure and actors, and drafting a waste management plan using risk-based segregation and treatment methods.
2. **Preparation** focuses on installing infrastructure (color-coded bins, reminder posters), designating waste storage areas, and conducting training to embed daily waste management routines.
3. **Execution** operationalizes waste cycles from segregation to treatment and disposal. It includes daily monitoring, adaptive management in response to workload shifts or new risks, and an exit strategy that ensures continuity and safe closure.

The guidelines offer practical tools, such as waste stream classification tables, treatment decision trees, pre-packed waste kits, visual training materials, and monitoring checklists. Specific recommendations target common weaknesses: overuse of single-use items, inadequate staff training, reliance on PVC materials, and lack of coordination across agencies.

The document concludes with strategic calls to action:

- Make waste management a mission-critical function;
- Train and involve all staff;
- Strengthen procurement practices by avoiding PVC and promoting reusable items;
- Build international-level support units with mobile treatment capabilities.

The overarching goal is to ensure that waste is managed safely, sustainably, and efficiently supporting both health outcomes and the humanitarian sector's commitment to "Do No Harm."

NON-TECHNICAL SUMMARY

The WORM WP5 guidelines help humanitarian teams manage waste better in field hospitals. These hospitals often operate in disaster or conflict zones with little waste treatment infrastructure, which can lead to environmental damage and health risks. The guidelines show that waste management is everyone's responsibility from doctors and nurses to logisticians and cleaners.

The guidelines recommend a step-by-step process: plan waste needs early, set up bins and storage areas before opening, and manage daily waste activities like sorting, transporting, and treating it safely. Visual tools, color-coded bins, and short training sessions are key. The guide also suggests buying fewer disposable items and avoiding harmful materials like PVC.

By improving how waste is handled, humanitarian operations can be safer, faster, and more respectful of the environment. The document encourages international support to provide equipment, training, and coordination so that all medical teams can focus on their lifesaving work without being overwhelmed by waste problems.

PREFACE

This guideline document is built upon the existing guideline documents and reports as cited in the reference section. Authors used editorial and structural support from AI-based tools to prepare this document although all content and decisions were made by the authors.

The humanitarian sector is built on the principle of rapid response to crises, ensuring life-saving aid reaches affected populations as quickly as possible. Over the years, humanitarian organizations have developed expertise in deploying emergency assistance under extreme conditions. However, as environmental and sustainability awareness grows, the sector is increasingly expected to address the long-term impacts of its operations. One of the most critical and challenging issues is waste management as regions and countries in which humanitarian interventions take place often do not have proper waste management infrastructure; hence, humanitarian organisations often need to manage their waste by themselves. Indeed, humanitarian interventions often generate significant amounts of waste, including packaging materials, construction debris, expired food, hazardous materials, and broken items such as electric and electronic equipment.

Among all humanitarian interventions, medical interventions generate the largest quantity of waste due to the widespread use of single-use items designed to prevent infection and contamination. In particular, field hospitals are deployed in conflict and post-disaster areas when existing healthcare systems collapse. These mobile facilities are essential for trauma care, surgeries, and epidemic response, but their operations produce high volumes of infectious and hazardous waste. Given the resource-limited settings where field hospitals operate, managing the waste becomes an enormous challenge.

This guideline intends to provide a holistic approach to waste management, not only medical waste but also general and hazardous waste, in humanitarian settings. It aims to support organizations in reducing waste, improving disposal practices, and adopting more harmonized solutions among the sector without compromising rapid response efficiency.

1. INTRODUCTION

Waste management in humanitarian field hospitals is often overlooked due to the prioritization of life-saving medical care. Limited time, staff, and materials force emergency medical teams (EMTs) to rely on improvised and makeshift solutions. Each organization brings its own budget, equipment, and protocols, while infectious waste, viewed as a public health threat, requires urgent on-site treatment as local waste management infrastructure is often paralyzed or non-existent. EMTs are often composed of staff from diverse cultural backgrounds with varying understandings of waste practices, leading to inconsistent attitudes towards waste and waste management practices. Frequent staff turnover further complicates training efforts. As a result, waste from field hospitals is commonly mixed and burned together in an incinerator such as drum incinerators, posing environmental and health risks.



1.1 Integral waste management

In this document, we present the concept of integral waste management that recognizes that every system within a health facility, including procurement, logistics, and clinical services, contributes to waste generation. Effective waste management must therefore be embedded as a systemic, cross-functional responsibility of all the staff involved in field hospital deployment. This approach ensures waste is simplified, minimized, handled safely, and disposed of responsibly, in alignment with both core humanitarian value of Do No Harm and the 3R principle (reduce, reuse, recycle).

Integration of waste types

Integral waste management (IWM) in field hospitals refers to a comprehensive, coordinated approach to managing all types of waste generated by field hospitals (general, recyclable, hazardous, and infectious waste), ensuring each is handled according to its risk and treatment requirements while minimizing the waste that gets incinerated (the most prevalent disposal method in humanitarian field hospitals).

Integration across functions

IWM also promotes integration across operational functions from waste generation and segregation at the point of use, to storage, internal transport, treatment, and final disposal. Each step must be planned and adapted to the specific constraints of the field setting while minimizing health and environmental risks.

Integration across actors

Effective waste management depends on collaboration between medical staff, WASH teams, logisticians, local authorities, and the community. Each plays a role in ensuring that systems are consistent, safe, and culturally appropriate.

IWM is, therefore, best understood as a system of systems: a coordinated network of smaller, interdependent systems working together. Each component, from procurement operates as a system with its own steps, responsibilities, and challenges with the common objectives of reducing waste and its

harm. These are connected across departments (procurement, health, WASH, logistics), waste types, and operational functions.

1.2 Three phases of integral waste management

Integral waste management approach organizes waste management into three interdependent operational phases:

1. **Planning:** Waste management is incorporated from the earliest stages of mission design. This includes identifying responsibilities, estimating types and quantities of waste, and understanding the local context and constraints. Planning also ensures that prevention, minimization, and segregation strategies are part of the operational concept.
2. **Preparation:** During the setup phase, systems and tools are mobilized to enable effective management. This includes sourcing appropriate materials and equipment (e.g., containers, labels, PPE), assigning trained personnel, and establishing internal protocols for segregation, storage, and emergency response.
3. **Execution:** Waste is managed as part of daily routines. Segregation at source, temporary storage, safe treatment or transport, documentation, and regular monitoring all take place as integral parts of the workflow — not as side activities. Feedback mechanisms ensure the system can adapt to changing conditions.

These phases are further described and discussed in the following chapters. Ultimately, integral waste management is about operational coherence, making waste everyone's responsibility, at every stage, through structured, practical, and context-driven systems.

1.3 Waste reduction recommendations

In resource-limited field hospital settings, reducing waste is essential for safety, efficiency, and environmental protection. The following practical recommendations can help minimize waste at every stage, from procurement to disposal.

1. Procurement-level reduction¹

- Procure only what is needed: Avoid overstocking consumables that may expire.
- Select products with minimal packaging: Choose bulk packaging or items with recyclable/biodegradable packaging when possible. For drugs, bulk packaging has not only economical but also logistic and environmental advantages².
- Prefer reusable over single-use items: metal instruments, washable gowns, or containers.
- Avoid PVC products: PVC creates toxic emissions when burned and should be replaced by safer alternatives such as polyethylene or polypropylene. See Annex 1 for more information.

2. Use-level reduction

- Rational use of medical supplies: Train staff on efficient use of gauze, gloves, etc.

¹ Sustainable health procurement guide note (UNDP, 2022): https://www.undp.org/sites/g/files/zskgke326/files/publications/undp-SPHS-bpps-health_Sustainable_Health_Procurement_Guidance_Note.pdf

² Blister packs for individually packaged medicines are made of PVC (polyvinyl chloride: a precursor compound to produce dioxins in thermal processes) and aluminum foil (can produce fine particulate matters and metal vapor when burned).

- Segregate at source³: Prevents contamination of general or recyclable waste with infectious materials.
- Avoid unnecessary PPE use: Match protective gear to actual risk levels.

3. Reuse and Repurposing

- Clean and reuse containers or non-sterile items where safe for non-clinical tasks.
- Repurpose clean packaging for storage, labelling, or other operational needs.

4. Coordination and Local Solutions

- Coordinate with other NGOs to share surplus items or reduce duplication.
- Engage local recyclers or artisans to repurpose waste into useful materials (e.g., bricks, floor tiles, crafts).

³ Most medical staff throws the packaging materials of sterilized medical items (ex. bandage and gauze) into the infectious waste bin. This practice magnifies the infectious waste volume; hence incineration frequency.

2. PLANNING - PRE-DEPLOYMENT PHASE: DEFINE, ANTICIPATE, PLAN

Planning is critical: effective waste management begins with anticipation by foreseeing the types and quantities of waste that will be generated before the intervention starts. This proactive planning helps reduce health and environmental risks, ensures smoother operations and compliance with safety standards.

The successful integration of integral waste management into humanitarian operations requires a thorough understanding of waste requirements and waste management capacity of the intervention. Waste management strategy must set a practical balance between environmental stewardship and intervention's requirements and identify feasible and sustainable waste management solutions. This section focuses on describing “how” integral waste management can be integrated throughout the intervention to build the basis for developing waste management plans regardless of the intervention types.

The process consists of 5 steps

- Step 1: Define waste profile
- Step 2: Anticipate constraints
- Step 3: Identify existing local systems
- Step 4: Draft the waste management plan
- Step 5: Define waste management kit

2.1 Define waste profile

Waste profile consists of two information types: waste streams and waste quantity.

Waste streams

Estimation of types/volumes based on services, patient load, and prior missions will facilitate the design of waste management plan. Waste generation depends on several factors: the type of services provided (e.g., surgery, maternity, diagnostics), patient load (inpatients vs. outpatients), and facility size. Prior mission data can guide these estimates (Annex 2 for waste log template).

WHO classification⁴ should be used to have a universal waste categorization practice throughout the sector. Waste streams lead to different collection and disposal methods; hence the segregation practice of all existing waste streams will facilitate the downstream final disposal. Recommended waste streams are summarized below:

⁴ WHO (2016). Health care waste management.

Table 1: Waste streams and color-coding system

Waste streams			Container type	Color code
General waste	Dry	Non-recyclables	Open bin	Black
		Recyclables	Open bin	NA
	Wet	Food waste	Bin with lid	Green
Medical waste	Dry + Wet	Infectious waste	PVC products	Yellow/Red
			Non-PVC only	Yellow/Red
	Dry	Sharps	Sharps box	Yellow/Red
	Wet	Pathological waste	Pedal bin with lid	Yellow/Red
Hazardous waste	Dry	Pharmaceutical waste	Bin with lid	Brown
	Dry + Wet	Chemical waste	Bin with lid	Brown

Waste quantity estimation method

Waste generation depends on several factors:

- Type of services provided (e.g., surgery, maternity, diagnostics)
- Patient load (inpatients vs. outpatients)
- Facility size

Previous intervention data can guide these estimates when local data is unavailable. It is widely accepted that 75–90% of healthcare waste is non-hazardous, while 10–25% is hazardous, which includes infectious (15%), sharps (1%), chemical/pharmaceutical (3%), and genotoxic waste (1%). In addition, WHO recommends using an average waste generation rate of 0.5 kg of hazardous waste per bed per day for planning in modern humanitarian settings. In resource-limited field hospital settings, it is reasonable to assume that hazardous waste ratio reaches its upper limit (25%); hence, the total waste per day per bed can be estimated at 2 kg/bed/day. These estimates can be used to plan treatment capacities and storage needs, especially in rapid deployments.

Tanzanian study surveyed the waste generation patterns from all 26 regions (over 100 healthcare facilities assessed through physical site visits with more facilities contacted remotely). The study describes a comprehensive national sample as shown in Table 2⁵.

⁵ Manyele, S., Anicetus, H., Habtu, M., Massa, K., Said, M., Saria, J., ... & Yoti, Z. (2022). Readiness of Healthcare Facilities to Implement Onsite Healthcare Waste Management Protocols and Incineration Guidelines in Tanzania. *Journal of Environmental Protection*, 13(11), 913-940.

Table 2 Results from waste generation survey in Tanzania

Average capacities	Regional	District	Health center
Bed capacity	261.3	103.4	50.5
Daily inpatients	103.7	43.7	28.7
Daily outpatients	441.4	176.9	72
Waste generation (kg/day)	785.7	311.6	60.6
kg/bed/day	3.007	3.014	1.5

Additionally, procedures like vaccinations, lab work, or dialysis can significantly influence the waste composition. If available, historical data from similar deployments or static health centers in the region should be used to refine the forecast. A clear waste profile supports efficient resource planning, system design, and risk mitigation.

2.2 Anticipate constraints

Anticipating environmental, logistical, and regulatory constraints ensures waste systems are realistic and resilient in the field. Geographic factors like remoteness, seasonal flooding, landslides, or poor road access can disrupt waste transport and disposal.

Legal constraints vary widely. Some countries require medical waste to be treated in certified incinerators, while others have no clear framework. Humanitarian teams must align with national and local regulations, and where rules are absent or vague, apply international standards such as those outlined in the WHO guidelines, Basel and Stockholm Conventions. Annex 4 provides international standards and those recommended by the humanitarian sector. In addition, a national waste-related law database from the Basel Convention's working group is presented with example AI prompts to extract the necessary information for rapid humanitarian responses.

2.3 Identify and assess existing local systems

Identification of existing waste management systems helps avoid duplication, identify gaps, and support sustainable integration. The process includes assessing infrastructure, actors, and applicable regulations.

First, identify the presence, functionality, and safety of final disposal facilities: landfills, incinerators, or controlled pits. In some cases, field teams may find only open dumping or unsafe burning options, in which case safe on-site treatment must be planned.

Next, identify local actors, in particular a medical waste management service provider will facilitate the field hospital waste management strategies drastically. Other actors include municipal waste services, private contractors, informal recyclers.

Understanding the stakeholder landscape is essential for negotiating access, forming partnerships, or planning handovers. A simple stakeholder assessment tools (list of stakeholders, questionnaire, and infrastructure checklist) are provided in Annex 5.

2.4 Draft the waste management plan

A robust waste management plan aligns procurement, logistics, medical, and WASH efforts around a shared system of systems. It must define the types of waste to manage, identify roles, specify workflows

from generation to final disposal, and specify required equipment. The plan should be simple, modular, and adaptable to changes in scale or staffing.

Selection of waste treatment methods

Determine the feasible waste disposal method for each waste stream based on the information gathered from Steps 1, 2, and 3. Figure 1 facilitates the decision-making process. It is recommended to utilize specialized waste management services (except for food and waste stream) if available to ensure appropriate treatment and disposal. The following table summarizes the recommended waste treatment and disposal if on-site treatment and disposal is the only option.

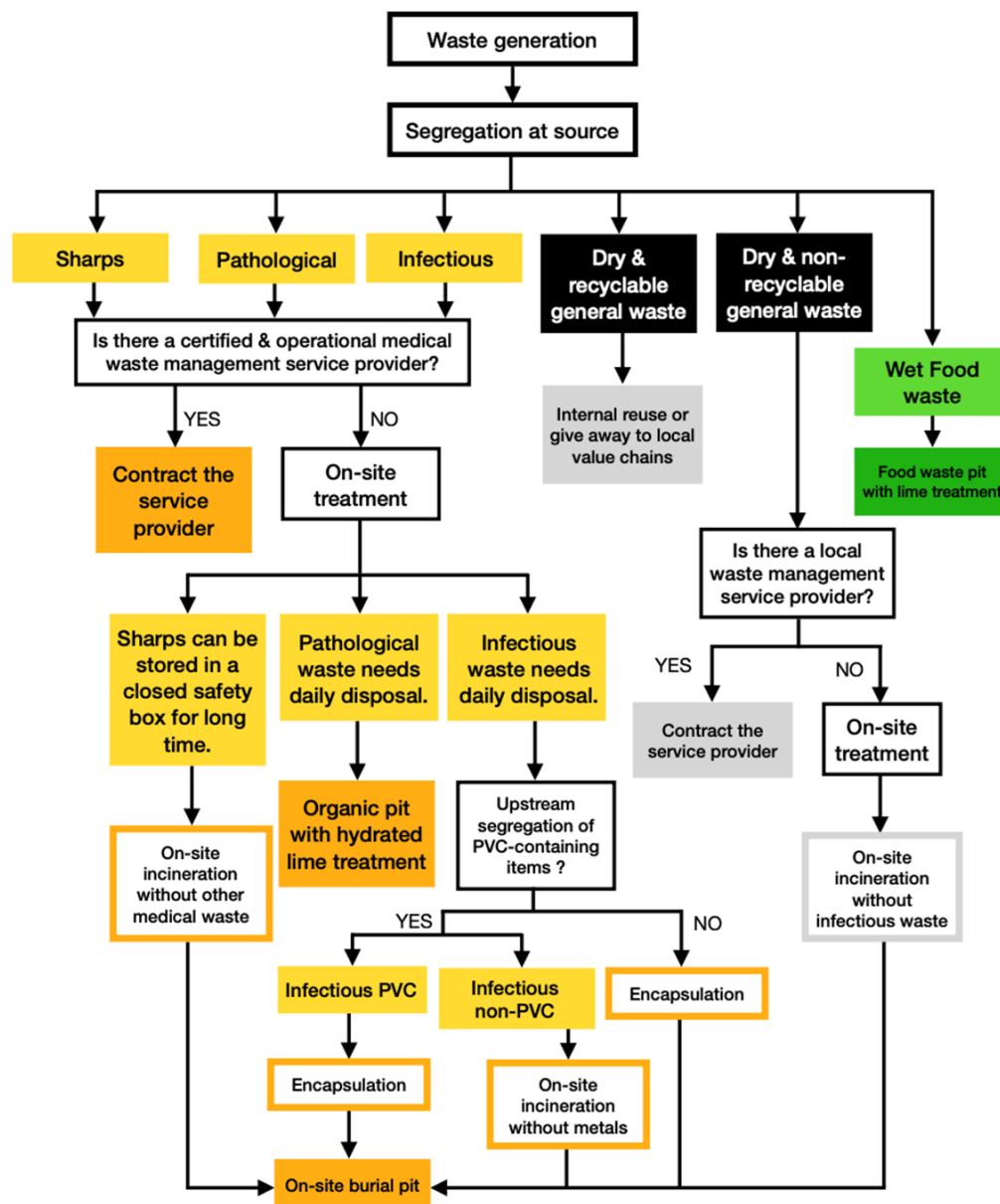


Figure 1: Waste management options decision tree

Table 3 Recommended on-site treatment and disposal methods

Waste stream	Collection	Storage	Treatment	Disposal
General (non-recyclable)	Collected in a black plastic bag	Stored in a bigger waste container with lid in the waste management zone.	Incineration without other waste streams	On-site burial pit (generated ash should be minimum)
Food waste	Collected in a green waste bin	No storage (dispose directly)		Food waste pit with hydrated lime treatment
Infectious waste	Collected in a yellow plastic bag with a label (Annex 2)	Stored in a bigger waste container designated for infectious waste (with a biohazard symbol)	Incineration without other waste streams	On-site burial pit
	PVC-containing infectious waste stream to be collected separately with a label (Annex 2)	Stored in a bigger waste container designated for PVC infectious waste (with a biohazard symbol)	Encapsulation	On-site burial pit
Sharps	Collected in a sharps box with a label (Annex 2)	Sharps boxes can be stored for a longtime	Incineration (avoid incineration with other materials as metals can catalyse some harmful chemical reactions during incineration)	On-site burial pit
Pathological waste	Collected in a yellow plastic bag with a label (Annex 2)	No storage (dispose directly)		On-site organic pit with hydrated lime treatment

Setting up daily operations

Begin by assigning roles across zones (e.g., triage, pharmacy, lab, inpatient wards). Clearly designate responsibilities for waste segregation, bin emptying, transport, treatment, and oversight. Include checklists, duty rosters, and visual SOPs to reduce reliance on verbal instructions, especially in high-turnover teams. Next, simulate workflows to analyse most practical bin placement, evaluate the frequency of waste bin emptying.

Following contents are summarized in annex documents:

- Preparation of waste management zone (Annex 6)
- Waste segregation posters (Annex 7)
- PPE usage (Annex 8)
- Waste collection procedure (Annex 9)
- Liquid waste emptying procedure (Annex 10)

2.5 Waste management kit

Waste management kit will enhance the preparedness and promote standardized practices. Many missions struggle to implement proper waste management systems early simply due to missing basic supplies. The example waste management kit is presented in Annex 11. It is recommended to include enough volume for at least 5 days of operation before resupply

3. PREPARATION - SETUP PHASE: BUILD, TRAIN, ACTIVATE

Before clinical activities begin, a functional and safe, but simple and visible waste management system must be established. The objective of this phase is to install infrastructure, train staff, assign roles, and activate procedures so that waste management becomes a routine part of field hospital operations from the very beginning. This phase provides the foundation for infection prevention and operational efficiency as well as for promoting a culture of safety and responsibility among the entire hospital team.

Install bins and reminder posters

All waste collection points must have color-coded bins with standardized pictograms and multilingual reminder posters for easy visualization. Bins should be placed at the point of waste generation, such as triage zones, outpatient areas, inpatient wards, pharmacies, and labs, to minimize the need for waste movement prior to segregation. The tips for strategic placement of waste bins are provided in Annex 12.

Reminder posters and other signs should be fixed at eye level and preferably laminated to avoid wearing. Example segregation posters are available in Annex 7.

Designate a waste storage area

A temporary storage area must be designated before waste treatment or transport begins. This space should be:

- Secure and lockable, to restrict unauthorized access
- Well-ventilated and shaded to reduce heat and odour
- Raised, for example by palettes, or protected from water runoff and pests
- Large enough to accommodate 3 days' worth of waste, separated by waste type

Hazardous and medical waste should be stored in leak-proof containers. Sharps must be stored in puncture-resistant boxes. All containers must be clearly labelled with the appropriate waste symbol. It is recommended that waste is weighed before storage to keep a record of waste generation patterns. Recommended waste management zone (with waste storage area) is presented in Annex 6.

Train Staff

Short, hands-on training sessions should be delivered to all categories of staff upon arrival to a field hospital. Staff must understand the reasons for systematic waste management practices, the risk of contamination, and their role and daily routines. [Training content includes:](#)

- Waste types and risk levels
- Correct segregation and bin usage
- Emergency spill response
- Internal waste transport protocols

According to WHO guidelines, visual training tools such as videos, infographics, SOP cards improve knowledge retention.

4. EXECUTION - OPERATIONAL PHASE: RUN, MONITOR, ADAPT

This chapter provides practical guidance for EMTs and supporting WASH personnel to implement daily waste management operations in humanitarian field hospitals.

Flexibility, anticipation, and readiness are the main virtue. Waste volumes and types may change with patient load, disease outbreaks, or new activities. EMTs must adjust quickly by reallocating bins, increasing collection frequency, or adapting temporary storage. This responsiveness ensures that the waste system continues to protect staff, patients, and the environment throughout the intervention. The operational phase is not about perfection, but about consistent, safe practices that reflect good planning and strong coordination.

Building on prior planning and preparation phases, this chapter outlines five key operational tasks: run the cycle, operate treatment, monitor, adapt, and prepare for exit.

Run the waste management cycle

Efficient waste management operations begin with the disciplined execution of the waste flow cycle:

1. Segregation at the point-of-generation (Annex 7)
2. Collection by waste management manager (Annex 9)
3. Internal transport with a trolley by waste management manager (Annex 9)
4. Temporary storage in the facility (Annex 6)
5. Treatment in the facility (if possible and applicable)
6. Final disposal (in the facility if impossible to outsource)

This cycle must be consistent, visible, and respected by all staff.

Recommended practices:

- Place clearly labelled, color-coded bins at points of waste generation. Follow consistent colour codes.
- Train all staff on correct bin use and ensure reminder posters are displayed in local and English languages.
- Define daily waste collection routines and transport routes (WHO bluebook section 7.5.3) to avoid accidental contamination of clean zones.
- Ensure waste storage areas are weather-protected, ventilated, and secured from unauthorized access.

Operate treatment

Treatment methods must align with available infrastructure and waste type. Field hospitals should avoid hazardous open burning and prioritize safer, context-adapted alternatives.

Recommended practices:

- General non-recyclable waste: Send to a local sanitary landfill. If not, on-site incineration without infectious waste to avoid the generation of toxic substances such as dioxins and furans.
- Do not correct mistakes: if non-hazardous material has been placed in a container for wastes entailing the risk of contamination, that waste must now be considered hazardous (precautionary principle).
- General recyclable waste: Reuse internally if clean, or invite waste pickers for local value chains.
- Food waste: Empty the food waste bin, without a liner if used, in an organic pit and add hydrated lime to avoid scavenger animals.

Hazardous waste

- **Sharps:**
 - Contract a specialized service provider.
 - If not, onsite management by disinfection combined with destruction of functionality to prevent the reuse.
 - Example treatment: non-destructive disinfection (autoclave, chemical, or other treatment) or incineration, then encapsulation in a container, sharps pit, or ash pit.
- **Infectious waste:**
 - Contract a specialized service provider.
 - If not, onsite management by incineration and ash pits.
 - PVC-containing medical waste should be disposed of by encapsulation and secure landfill disposal, if possible (Annex 1 for more information).
 - Anatomical and pathological waste:
 - Dump in an anatomical (placenta) pit onsite with hydrated lime. Anatomical waste must not be mixed with food waste. It requires dedicated burial with cultural consideration
- **Pharmaceuticals:**
 - Contract a specialized service provider.
 - If not, segregate expired or unused medicines and dispose of via encapsulation (65% pharmaceutical waste, 15% hydrated lime, 15% cement, and 5% water).
 - Authorized return systems where possible.

Avoid burning any plastics, chemicals, or mixed hazardous waste in open drums or low-tech incinerators, unless they are emissions-controlled.

Monitor

Routine monitoring during execution helps identify gaps early, such as overflowing bins, improper segregation, or broken containers. Waste focal points or supervisors should observe practices regularly and address issues quickly, through reminders, reinforcement, or adaptation of the setup.

Routine monitoring is vital to ensure compliance, detect failures early, and maintain safe operations. A structured system for visual inspections, documentation, and reporting supports accountability and improvement.

Monitoring tools:

- Visual checklists at each waste zone for bin placement, fill levels, and misuse.
- Daily logbook or app-based tracker for volumes collected, treated, or stored.
- Incident log for spills, needle-stick injuries, or bin misuse.
- Weekly compliance reviews by the WASH lead, and monthly reporting to HQ/logistics coordination cell.

Adapt

Field hospital conditions shift rapidly based on patient load, security, and logistics. Waste operations must be continuously adjusted to reflect real needs.

Adaptive management recommendations:

- Increase collection frequency and bin capacity in high-demand zones during outbreaks or surgery peaks.
- Add temporary storage or switch to external service providers when internal systems are overwhelmed.
- Update staff training when errors in segregation are detected during monitoring.

- Revisit disposal site design if groundwater contamination or overflow risk arises.

Adaptation must be documented to maintain continuity during team rotation.

Prepare for Exit

As field operations wind down, safe transition of waste management responsibilities is critical to avoid leaving behind risks.

Exit strategy steps:

- Prepare a handover document summarizing segregation protocols, volumes handled, remaining waste, treatment logs, and system diagrams.
- Brief incoming EMTs, local health authorities, or facility managers on ongoing waste handling duties and safe closure or transition of pits and burial sites.
- Where possible, integrate local waste workers into ongoing operations or initiate referrals to external disposal services.
- Decommission treatment infrastructure (e.g., autoclaves or mobile incinerators) per manufacturer and WHO decontamination protocols.

5. CONCLUSION AND RECOMMENDATIONS

Waste management in humanitarian field hospitals is often seen as a technical or logistical issue. In reality, it is an operational challenge that affects patient and staff safety, environmental health, and the duty of humanitarian actors to act responsibly and sustainably. Despite being a visible and constant task, it is rarely treated as a shared responsibility or a strategic priority.

This final chapter summarizes the key messages from the previous sections and states practical recommendations for field EMTs, humanitarian agencies, and donor organisations. It aims to turn waste management from a forgotten problem into a coordinated and effective system that supports EMTs in focusing on their core life-saving mission.

Field realities and daily challenges

In humanitarian field hospitals, waste management is not a side task but it is a daily, essential activity that affects safety, dignity, and health. Yet in most deployments, it remains under-resourced, under-supported, and left to a few individuals with improvised tools, planning, and inconsistent training. This often leads to general waste being mixed with infectious waste, which increases the volume that must be treated as hazardous and incinerated. The reality is that staff are overworked, materials are often missing, and teams rotate frequently.

Supporting field teams must go beyond this document — it requires coordinated guidance, reliable resources, and recognition that waste management is fundamental to quality care.

Waste is everyone's responsibility

For waste management routines to function in field hospitals, all staff must be involved. Doctors, nurses, logisticians, WASH officers, cleaners: everyone plays a role.

- Bins must be used correctly.
- Transport must follow the right route.
- Treatment must be done safely.
- Monitoring protocol must be developed and followed.

Clear roles, visual tools, short but concise training for all staff, and daily practice with feedback mechanism to adapt the situation must be integrated in the mission planning phase.

Procurement makes a big difference

Many of the waste challenges in the field start with procurement. When procurement teams buy too many single-use items, PVC-based supplies, or overpackaged products, the result is more waste that is harder to manage.

Procurement officers should be trained to:

- Avoid products with PVC and toxic materials.
- Choose bulk packaging items and kits.
- Prefer reusable over disposable items when possible.

Making good procurement choices reduces waste and saves time and effort from field EMTs.

Support from the international level is needed

Field teams do their best — but the pressure is high, and the conditions are hard. That's why we need stronger support from the international humanitarian community.

We recommend creating or strengthening a dedicated Waste Management Support Unit that can:

- Provide technical guidance and materials during emergencies.



- Train rapid response teams on waste protocols.
- Deploy mobile waste management unit (such as a high-performance incinerator) and provide collection service to ease the waste disposal burden from field EMTs.

This would take pressure off medical teams and help ensure that waste is managed responsibly from day one and for all medical teams: local, national, international entities.

5.1 Final Recommendations

To improve waste management in humanitarian field hospitals, we recommend:

- Make waste management one of the core responsibilities of all staff.
- Include waste training in staff induction and daily routines.
- Build waste-friendly procurement into supply chains.
- Fund and pre-position waste kits for quick setup.
- Track basic waste indicators to improve accountability.
- Coordinate across agencies to avoid duplication and improve system design.
- Support local contractors and value chains when it is safe and legal to do so.
- Create a shared pool of technical experts for waste management in emergency deployments.

REFERENCES

1. International Committee of the Red Cross (ICRC). *Medical Waste Management*. Geneva: ICRC, 2011. <https://www.icrc.org/en/doc/assets/files/publications/icrc-002-4032.pdf>
2. Wisner, B., and Adams, J., eds. *Environmental Health in Emergencies and Disasters: A Practical Guide*. Geneva: World Health Organization, 2002. <https://www.who.int/publications/i/item/environmental-health-in-emergencies-and-disasters>
3. World Health Organization (WHO). *Classification and Minimum Standards for Emergency Medical Teams*. Geneva: WHO, 2021. <https://www.who.int/publications/i/item/9789240029330>
4. The Global Fund. *Technical Brief: Avoidance, Reduction and Safe Management of Health Care Waste (2023–2025)*. Geneva: Global Fund, 2022. <https://www.theglobalfund.org/en/sourcing-management/health-products/healthcare-waste-management/>
5. WHO and UNICEF. *WASH in Health Care Facilities 2023 Data Update: Special Focus on Primary Health Care*. Geneva: WHO and UNICEF, 2024. <https://washdata.org>
6. Manyele, S., H. Anicetus, M. Habtu, K. Massa, M. Said, J. Saria, G. Saguti, and Z. Yoti. “Readiness of Healthcare Facilities to Implement Onsite Healthcare Waste Management Protocols and Incineration Guidelines in Tanzania.” *Journal of Environmental Protection* 13 (2022): 913–940. <https://doi.org/10.4236/jep.2022.1311058>
7. Pan American Health Organization (PAHO) and World Health Organization (WHO). *Guidelines for the Use of Foreign Field Hospitals in the Aftermath of Sudden-Impact Disasters*. Washington, D.C.: PAHO, 2003. https://www.who.int/hac/techguidance/tools/FFH_guidelines_EN_web.pdf
8. United Nations Development Programme (UNDP). *Healthcare Waste Management Toolkit for Global Fund Practitioners and Policy Makers: Part A – Rationale for Environmental Safeguard Policies and Strategies*. New York: UNDP, 2015. <https://www.undp.org/publications/healthcare-waste-management-toolkit-global-fund-practitioners-and-policy-makers-part>
9. United Nations Development Programme (UNDP). *Healthcare Waste Management Toolkit for Global Fund Practitioners and Policy Makers: Part B – Waste Stream Concept Development*. New York: UNDP, 2015. <https://www.undp.org/publications/healthcare-waste-management-toolkit-global-fund-practitioners-and-policy-makers-part-b>
10. United Nations Development Programme (UNDP). *Sustainable Health Procurement: Guidance Note*. New York: UNDP SPHS, 2020. <https://savinglivesustainably.org/>
11. World Health Organization (WHO). *Safe Management of Wastes from Health-Care Activities: A Summary*. Geneva: WHO, 2014. <https://www.who.int/publications/i/item/9789241548564>
12. Centers for Disease Control and Prevention (CDC). *Waste Treatment Facility Inventory – January 2024*. Atlanta: CDC, 2024. <https://www.cdc.gov/infectioncontrol/pdf/guidelines/waste-treatment-facility-inventory-2024.pdf>
13. Eawag/Sandec, IFRC, GTO, and Partners. *Compendium of Solid Waste Management in Humanitarian Contexts*. 1st ed. Zurich: Swiss Federal Institute of Aquatic Science and Technology (Eawag), 2024. <https://www.eawag.ch/en/departement/sandec/publikationen/compendium-series/>

ANNEX 1

Dioxins and the Hidden Danger of Improper Medical Waste Incineration

What are dioxins?

Dioxins are highly toxic chemical compounds regulated under the Stockholm Convention and EU's POPs (persistent organic pollutants) regulations. They are known to cause cancer, damage the immune system, interfere with hormone function, and affect reproduction and development. Even at very low concentrations, dioxins pose serious long-term health and environmental risks. Even in extremely small amounts, they can cause serious health effects. Short-term (acute) exposure can lead to skin lesions (chloracne), liver damage, and respiratory irritation. Long-term exposure is linked to cancers, immune system suppression, hormonal disruption, infertility, and developmental disorders in children, including learning difficulties and birth defects.

Dioxins are persistent in the environment and accumulate in the food chain, especially in animal fats. Once released—especially into the air or soil—they can contaminate crops, water sources, and livestock, putting entire communities at long-term risk.

How are dioxins generated?

Dioxins are released when organic materials containing chlorine, such as PVC (polyvinyl chloride), are burned at incomplete combustion temperatures (typically between 200°C and 800°C). These conditions are common in low-tech or single-chamber incinerators. Even with high-performance incinerators, dioxins are reported to form in the process of flue gas cooling; hence, without advanced flue gas treatment systems, dioxins are emitted directly into the air or remain in ash and residues, contaminating the environment.

Why is medical waste incineration high-risk?

Medical waste often includes PVC-based products (e.g., IV bags, gloves, tubing), packaging of drugs, and synthetic materials. For humanitarian actors, this means that the incineration of medical waste containing PVC components can silently cause widespread harm to both human health and the environment, often in areas already facing multiple vulnerabilities.

What can we do?

- 1. Replace PVC-containing products**

Humanitarian procurement policies should prioritize non-PVC alternatives (e.g., PE, PP, or silicone-based products) where available, reducing the source of dioxins at the outset.

- 2. Segregate and encapsulate PVC-containing waste**

PVC-containing items should be separated at source and placed in a dedicated stream. This waste can then be encapsulated (e.g., sealed in containers with cement or other binding material) to prevent future combustion or release.

- 3. Invest in high-performance medical incinerators**

The sector should promote the adoption of double-chamber, high-temperature incinerators with secondary combustion (>850°C) and proper flue gas treatment, ensuring dioxins are destroyed and emissions controlled.

A prevention-first approach—starting with procurement and segregation—is more realistic and safer in most humanitarian contexts than relying on advanced incineration alone.

PVC-containing single use medical equipment

IV and blood bags



Catheters and tubes



Respiratory equipment



PVC medical gloves



Inflatable splints



Blister packaging



Patient ID bracelets



ANNEX 2

Waste management recording tools

1. Waste data log sheet taken from WHO (2014)⁶, Table 2.4 p14
2. Waste labels to be printed on adhesive paper taken from Healthcare Waste Management Toolkit for Global Fund Practitioners and Policy Makers⁷

1. Waste data log sheet (modify in the local language if needed)



Name of health facility: Name of data collector: Number of occupied beds: Number of outpatients:	Organization Logo:
---	--------------------

Date	Collected from (name of the ward)	Type of waste	Weight (kg)	Notes

⁶ Safe management of waste from health-care activities, 2nd ed. <https://www.who.int/publications/i/item/9789241548564>

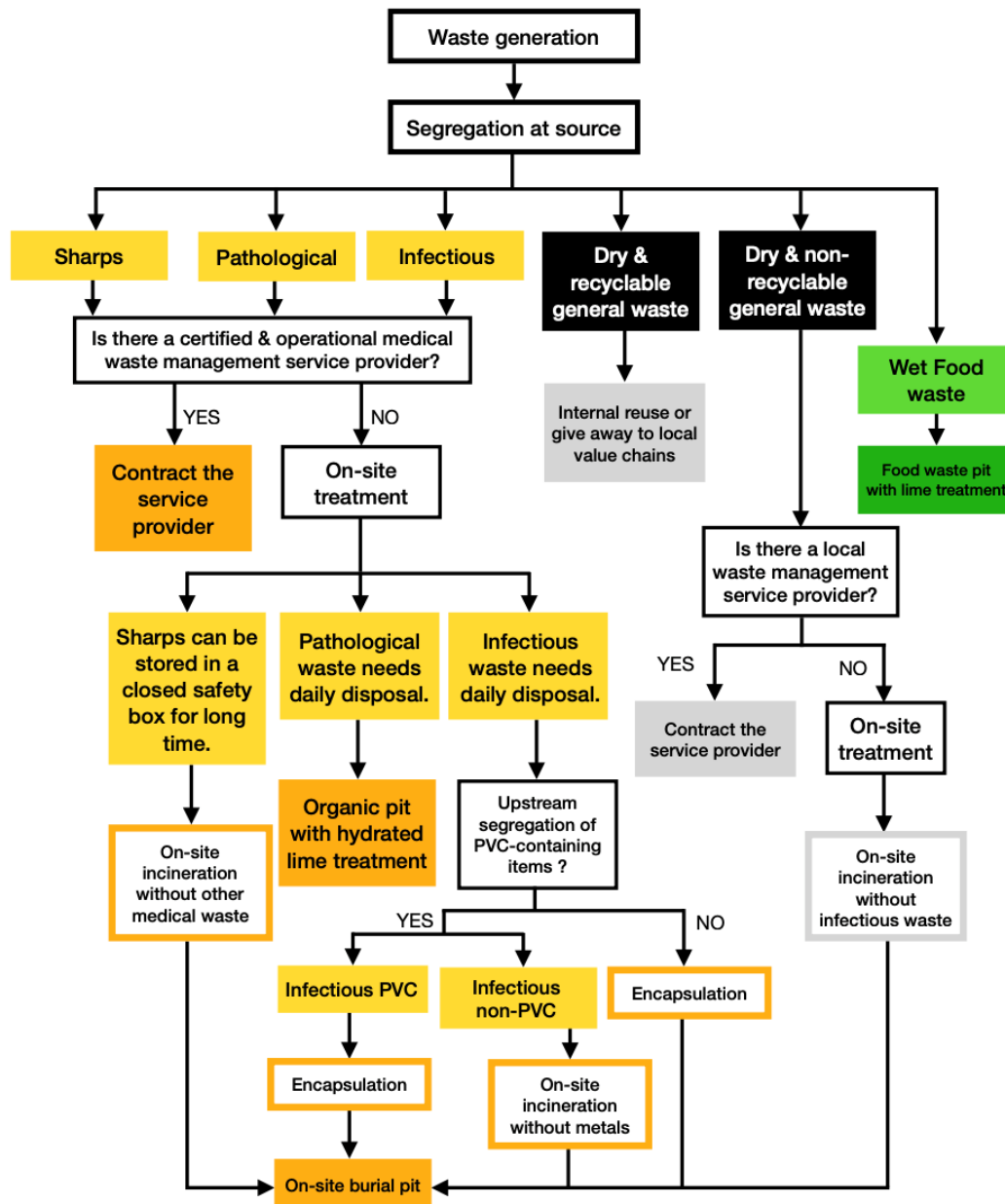
⁷ <https://api.savinglivesustainably.org/documents/file/38115c700684226ac1547c383daa78ca/full/hash>

2. Waste label for infectious or chemical waste (modify in the local language if needed)

 BIOHAZARD	<p>Department/ward: _____</p> <p>Date of generation: _____</p> <p>Collected by (name): _____</p> <p>Note: _____</p>		
 TOXIC	<p>Department/ward: _____</p> <p>Date of generation: _____</p> <p>Collected by (name): _____</p> <p>Note: _____</p>		

ANNEX 3

Waste management option by waste stream



Waste Management option chart

ANNEX 4

Regulatory frameworks on waste management

Humanitarian organizations operate in diverse environments where the development of waste management infrastructure is often limited. While the urgency of humanitarian response often requires rapid decision-making, organizations must also ensure that their waste management practices align with legal and environmental standards. Therefore, regardless of the development level of local waste management infrastructure, humanitarian organizations must integrate their waste management strategies as an integral part of the response planning. Indeed, the Sphere Standards (2019)⁸ provide guidelines for solid waste management in humanitarian settings to protect public health and the environment as one of six WASH focus areas. Key recommendations include planning waste management based on public health risks, assessing local capacities for reuse, recycling, or composting, and ensuring proper collection, transportation, and disposal. Solid waste should be safely contained to prevent pollution, vector breeding, and community health hazards. Special attention is given to medical waste management, requiring segregation, high-temperature incineration, or safe burial to prevent contamination risks.

In this section, we will explore existing waste management frameworks at both international and national levels by providing available resources and database. International frameworks are presented as Conventions while national frameworks are integrated as national laws. By adhering to these regulatory frameworks, humanitarian organizations can ensure that their operations not only meet emergency needs but also uphold environmental responsibility and long-term sustainability.

1.1 International frameworks

International conventions set important guidelines for waste management in humanitarian interventions, ensuring that waste is handled safely and responsibly. Key agreements include the Basel, Stockholm, Rotterdam, and Minamata Conventions, among others. These frameworks influence how humanitarian organizations manage and dispose of waste, particularly hazardous materials, in crisis settings. They help ensure compliance with environmental standards, reduce harm to communities, and promote sustainable waste solutions. By aligning with these international agreements, humanitarian actors can improve waste management practices, minimize environmental impact, and contribute to long-term resilience in the areas where they operate. Conventions that influence the waste management practices listed below with brief explanation:

1.1.1. Basel Convention (1989)⁹

The Basel Convention regulates the transboundary movement of hazardous waste to prevent its dumping in developing countries. It requires prior informed consent (PIC) from importing and transit nations before shipment and promotes waste minimization, environmentally sound management, and responsible disposal. The convention aims to reduce hazardous waste production, encourage local treatment, and ensure safe disposal methods that do not harm human health or the environment. It also combats illegal waste trafficking by enforcing stricter regulations on exporting and importing hazardous materials between nations.

⁸ <https://www.spherestandards.org/handbook/editions/>

⁹ <https://www.basel.int/>

1.1.2. Stockholm Convention (2001)¹⁰

The Stockholm Convention seeks to eliminate or restrict Persistent Organic Pollutants (POPs)—toxic chemicals that accumulate in the environment and pose severe health risks. POPs include substances like dioxins, furans, PCBs, and certain pesticides. The treaty requires parties to ban or phase out hazardous POPs, use safe disposal techniques, and find less harmful alternatives. It also emphasizes monitoring and research to track the environmental and health impacts of POPs. By controlling these pollutants, the convention helps reduce global contamination, protect ecosystems, and safeguard human health.

1.1.3. Minamata Convention (2013)¹¹

The Minamata Convention focuses on controlling mercury pollution to protect human health and the environment. It restricts the use, trade, and disposal of mercury, requiring parties to phase out mercury-containing products (e.g., thermometers, batteries) and reduce mercury emissions from industries like mining, healthcare, and waste incineration. The treaty also mandates safe storage and disposal of mercury waste and supports international cooperation in monitoring and minimizing mercury exposure. Its ultimate goal is to prevent mercury poisoning, particularly in vulnerable communities, and to ensure safer alternatives are adopted globally.

1.1.4. Bamako Convention (1991)¹²

The Bamako Convention is an African-led treaty that bans the import of hazardous waste into Africa and controls its movement within the continent. It was created in response to toxic waste dumping in African countries due to weaker environmental regulations. The treaty prohibits the export and import of hazardous materials, including radioactive and medical waste, and requires safer disposal methods. By strengthening regional cooperation and enforcing strict waste management policies, the Bamako Convention helps African nations prevent environmental contamination and protect public health from hazardous waste exposure.

1.1.5. Waigani Convention (1995)¹³

The Waigani Convention bans the import of hazardous and radioactive waste into Pacific Island countries and regulates its movement within the region. Recognizing the vulnerability of small island nations to pollution, the treaty prohibits the transboundary movement of toxic waste unless it is handled under strict environmental controls. It also promotes regional collaboration in waste reduction, recycling, and safe disposal. By preventing illegal dumping and encouraging sustainable waste management, the convention helps protect marine ecosystems and the health of Pacific communities.

1.1.6. Kyiv Protocol (2003)¹⁴

The Kyiv Protocol aims to enhance transparency and public access to information on pollution and waste management. It requires countries to establish Pollutant Release and Transfer Registers (PRTs)—public databases tracking hazardous waste production, emissions, and disposal activities. By improving data accessibility, the protocol helps governments, businesses, and civil society monitor environmental pollution and enforce better waste management policies. This framework supports evidence-based decision-making, promotes corporate accountability, and encourages nations to adopt cleaner, more sustainable waste management practices.

¹⁰ <https://chm.pops.int/>

¹¹ <https://minamataconvention.org/en>

¹² <https://www.unep.org/bamako-convention>

¹³ <https://www.sprep.org/convention-secretariat/waigani-convention>

¹⁴ <https://unece.org/env/pp/protocol-on-prtrs-introduction>

These conventions guide global waste management efforts, ensuring safe disposal, pollution control, and international cooperation. They influence humanitarian and development operations, requiring organizations to manage waste responsibly and in compliance with environmental laws.

1.2 National framework

Most developing countries have national laws regulating waste management, but in many cases, these laws are not consistently enforced or well understood by humanitarian organizations. Despite this, compliance with national waste regulations is crucial to prevent environmental damage, avoid legal issues, and promote sustainable interventions.

A comprehensive database maintained by the Basel Convention ([National Legislation Database](#)) provides access to waste management laws from almost all countries. However, many humanitarian organizations remain unaware of these legal frameworks, leading to improper disposal of hazardous and non-hazardous waste.

To ensure compliance with national regulations, humanitarian organizations should:

Identify waste-related national laws before deploying operations.

Collaborate with local and national authorities to develop waste disposal plans.

Allocate resources for proper waste treatment, including hazardous waste disposal.

Advocate for environmentally sound waste solutions, including recycling and reuse strategies where possible.

Tool Box 1: National Legislation Database

The Basel Convention Secretariat maintains the database of all national waste-related laws. You can select the country of your interest to have a list of all laws provided in PDF document.

For a quick understanding of the national legislative framework, you can provide the laws in PDF format to generative AI programs such as ChatGTP and Gemini to extract the main obligations and requirement expected from your intervention. Such quick knowledge will facilitate the discussion with local authorities and the finding of appropriate local service providers (if present).

Figure 1: Screenshot of the database for presentation purpose

The screenshot displays the 'Text of National Legislation' interface. At the top, there are tabs for 'BRS CONVENTIONS', 'BASEL CONVENTION' (selected), 'ROTTERDAM CONVENTION', and 'STOCKHOLM CONVENTION'. Below these is a navigation bar with links: 'Home', 'The Convention', 'Procedures', 'Implementation', 'Countries', and 'Partners'. A search bar is located on the right of the navigation bar.

The main section is titled 'Text of National Legislation'. It contains several input fields for filtering results:

- Treaty:
- Year:
- Language:
- Country: (with a close button 'x')

Below the filters, there are three search results for the 'Democratic Republic of the Congo', all with a submission date of 'February, 2011'.

Result 1:

- Language: Français
- Title: **Projet de loi sur l'environnement**
- Link: [doc](#)

Result 2:

- Language: Français
- Title: **Projet de decret, loi sur l'environnement**
- Link: [doc](#)

Result 3:

- Language: Français
- Title: **Law 3-91 on protection of the environment (23 April 1991)**
- Link: [doc](#)

At the bottom, there is a pagination control showing '1' of 3 items, with navigation arrows and a '1 - 3 of 3 items' indicator.

1.3 Humanitarian standards for waste management

The Sphere Standards provide best practices for waste management in humanitarian operations. Solid waste management standards are included in the WASH practice section with three standards:

Standard 5.1 Environment free from solid waste (pages 126 - 128)

Standard 5.2 Household and personal actions to safely manage solid waste (page 128)

Standard 5.3 Solid waste management systems at community level (page 129)

Key actions for the standard 5.1 include:

Design the solid waste disposal programme based on public health risks, assessment of waste generated by households and institutions, and existing practice.

Work with local or municipal authorities and service providers to make sure existing systems and infrastructure are not overloaded, particularly in urban areas.

Organise periodic or targeted solid waste cleanup campaigns with the necessary infrastructure in place to support the campaign.

Provide protective clothing for and immunise people who collect and dispose of solid waste and those involved in reuse or repurposing.

Ensure that treatment sites are appropriately, adequately and safely managed.

Minimise packing material and reduce the solid waste burden by working with organisations responsible for food and household item distribution.

Take-home box 1 Waste management is a legal and ethical responsibility.

1. International conventions set the baseline for waste management.
2. National laws vary. The Basel Convention's national legislation database provides PDF files of all existing national laws that can be analysed by a generative AI.
3. Early coordination with local authorities is crucial.
4. Sphere standards recommend:
 - Risk-based waste management planning
 - Proper waste segregation, safe disposal, and treatment
 - Protecting workers handling hazardous waste
 - Providing communities with safe waste disposal options
 - Minimizing waste generation through sustainable procurement

ANNEX 5

Stakeholder assessment guidelines

1. Identification of waste management stakeholders

Generalized stakeholder landscape is summarized in the table below. The stakeholder structure and hierarchy increase significantly with the country's income level, but there are mainly three stakeholder groups to be assessed:

Governmental institutions

Waste management service providers (public and private)

Local healthcare waste generators

By assessing at least one of these three stakeholder groups, important information on the availability of local waste management infrastructure can be identified prior to the field hospital deployment. Such assessment should be done in a collaborative and collective manner by the consortium of humanitarian organizations to avoid duplication of work.

Stakeholder entity		Roles and responsibilities
Governmental institutions (National and Local)	Ministry of environment Ministry of sanitation Ministry of public health	Setting environmental policies, plans, strategies Issuing permits for waste treatment and disposal Licensing waste treatment facilities Classifying healthcare waste and setting disposal conditions Supervising waste disposal List of authorized service providers
Waste management service providers		Municipalities, private sector actors, NGOs involved in waste management Collection, transport, treatment and disposal of waste If licensed, capacity to treat healthcare waste according to local regulations
Healthcare waste generators (local healthcare facilities)		Knowledge of local waste regulations, service providers, and practices Potential on-site treatment facility

2. Questionnaires for local stakeholder assessment

These questionnaires aim to support humanitarian actors in gathering necessary information from local stakeholders regarding:

Waste-related regulations

Available infrastructure and services

Roles, responsibilities, and costs

Potential for collaboration or contracting

2.1. Questionnaire for governmental institutions

Sample Questions	
Regulatory Framework	What regulations apply to healthcare or hazardous waste management in this region?

Presence of disposal site	<p>Is there a municipal waste disposal site?</p> <p>What type of disposal? (landfill, incinerator, etc.)</p> <p>Can we dump our segregated general waste there?</p>
Presence of service	<p>Is there public waste management service for municipal solid waste (MSW)?</p> <p>Can we have the contact information of the service providers (public and private)?</p> <p>Is there any healthcare waste management service provider?</p> <p>Can we have their contact information?</p>

2.2. Questionnaire for MSW service providers (public or private)

Sample questions	
MSW management services provided	<p>Can you collect the segregated general waste from our field hospital?</p> <p>What is the disposal methods used? (e.g., incineration, landfill)?</p> <p>What is the frequency of waste collection service per week?</p> <p>What is the service cost for waste collection and disposal?</p> <p>Are your operations authorized or licensed by the local government?</p>
Healthcare or hazardous waste management service provider	<p>Is it possible to collect the healthcare and/or hazardous waste from our field hospital?</p> <p>What is the treatment method?</p> <p>Can you issue the proof of disposal?</p> <p>What is the frequency of waste collection service per week?</p> <p>Do you require special conditioning (waste bags, boxes, containers, specific segregation and labelling requirements) of healthcare waste?</p> <p>Do you provide your harmonized materials for waste collection?</p> <p>What is the service cost for healthcare and/or hazardous waste collection and disposal?</p>

2.3. Questionnaire for local healthcare waste generators (e.g., clinics, hospitals)

Sample questions	
Collection Services	<p>Do you rely on public or private service providers for the collection of general and/or medical waste?</p> <p>Can we have the contact information of the service provider?</p> <p>How frequently?</p>
On-site treatment	<p>Do you have a high-temperature incinerator on site for your own medical waste treatment?</p> <p>Can we rely on your incinerator to treat our medical waste?</p> <p>If so, what are the segregation rules?</p> <p>What is the service cost?</p>

ANNEX 6

Designing and preparation of the waste management zone

In humanitarian field hospitals, waste management is an integral safeguard measure for health, safety, and environmental integrity. Unlike permanent facilities, field hospitals face the added challenges of short deployment timelines, limited infrastructure, and rapid staff turnover. Thus, preparing an efficient and safe waste management zone must be done strategically, with consideration of the upstream planning and logistical context.

1. Principles of waste zone design

A well-prepared waste zone must be:

- Safe – protects staff, patients, and surrounding populations.
- Accessible – located close enough to clinical areas but downwind and away from sensitive zones.
- Expandable – allows scaling up during protracted responses.
- Compliant – respects local legal and environmental regulations where feasible.
- Simple – uses low-tech, easily trainable procedures and structures.

2. Location criteria

- Located within or adjacent to the field hospital compound.
- Positioned downwind from wards and shelters (ICRC, WHO).
- Not prone to flooding, with stormwater drainage capacity (SCI).
- Allowing restricted access through fencing or barriers.
- Vehicle access for future transport or removal of waste.

3. Minimum required operational zones

Sub-Zone	Description
Storage area (covered)	Temporary waste storage space: 2–3 days maximum. Differentiated by waste stream (ICRC, SCI). Each waste stream with its own large container.
Treatment area	Manual incinerator, burial pits or autoclave if available.

4. Materials and Equipment

The following low-cost and field-adaptable materials are recommended:

Equipment	Use case
Fencing or tarpaulin walls	To secure and isolate the zone.
Pallets or bricks	To levate storage containers off the ground.
240L bins or barrels	Color-coded or labelled for infectious and general waste.
Plastic sheets or metal roofing	For rain cover over storage area.
On-site incinerator	To destroy infectious waste, preferably double-chamber model.
Ash pit	Lined pit for safe burial of incineration residues.
Trolleys or carts	For internal waste transport.

5. Checklist for initial setup

Task	Responsible	Done
Site selected	Logistics lead	<input type="checkbox"/>
Waste zone perimeter secured	WASH/logistics	<input type="checkbox"/>
Roofing/covering installed	Logistics	<input type="checkbox"/>
Storage bins labeled and color-coded	WASH team	<input type="checkbox"/>
Incinerator and/or pits prepared	WASH/logistics	<input type="checkbox"/>
Trolleys and PPE ready	Logistics/WASH	<input type="checkbox"/>
Hygiene and PPE area functional	WASH	<input type="checkbox"/>
Waste management plan and duty roster posted	WASH/nurses	<input type="checkbox"/>

6. Planning an effective waste management zone

The effectiveness of a waste management zone depends heavily on upstream activities, including:

- Realistic estimation of waste volume to size the facility appropriately.
- Procurement of waste management kit (Annex 12)
- Coordination with host country on transport or disposal options (Annex 5).
- Segregation compliance in medical zones (Annex 7).
- Training of all staff on waste categories and procedures.

ANNEX 7 SEGREGATION PROMOTION POSTERS

General waste

Thank you for separating waste into different bins.
Only the non-recyclable and non-infectious general waste in this bin.



E-waste bin



Food waste bin



Recyclable box



Infectious waste
bin

Infectious waste

Thank you for separating infectious waste.

Infectious waste spreads disease and requires segregation as it is the only waste that gets incinerated.



Infectious Waste Reduction

Infectious waste needs incineration to avoid infection of healthy people.
Incineration is costly and damages the environment.

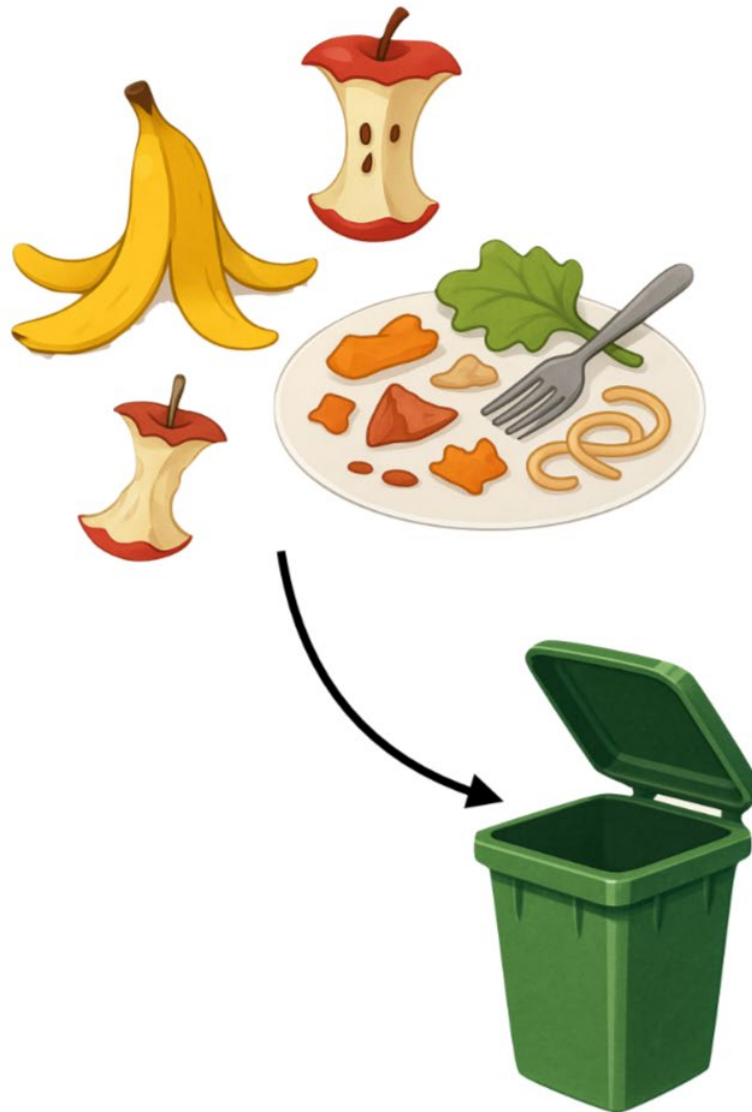
**Thank you for helping us reduce infectious waste
through careful waste segregation.**



Food Waste

Food waste is a safe waste, but it can dirty other waste.
We don't send food waste into a dumpsite because it attracts
scavenger insects and animals, making the dumpsite filthy.
We safely bury this waste on-site.

Thank you for separating food waste into this green bin.



Recyclable Waste

We collect recyclable waste and keep them clean.
We can reuse it onsite, and give to the local community.

**Thank you for separating recyclable waste
in the cardboard box**

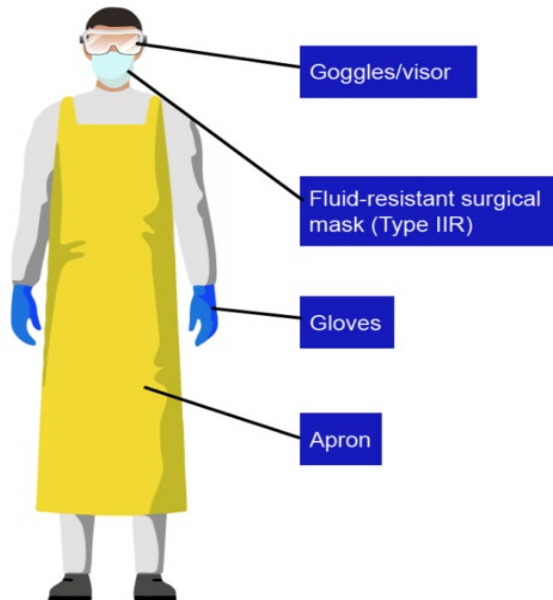
- Hard plastic containers
- Drink bottles
- Paper boxes for packaging
- Cardboard boxes
- Glass containers



ANNEX 8 PROTECT YOURSELF POSTERS

Personal Protective Equipment (PPE) in primary care

For any direct patient care (within 2 meters) and for collection of nasopharyngeal swab(s), use standard PPE. Dispose of PPE as clinical waste after use.



© St George's, University of London

Putting on personal protective equipment (PPE) in primary care

Pre-donning instructions

- Ensure healthcare worker hydrated
- Tie hair back
- Remove jewellery
- Check PPE in the correct size is available

1

Perform hand hygiene before putting on PPE.



2

Put on apron and tie at waist.



3

Put on facemask - position upper straps on the crown of your head, lower strap at nape of neck.



4

With both hands, mould the metal strap over the bridge of the nose.



5

Don eye protection if required.



6

Put on gloves.

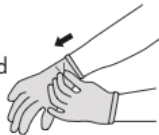


Taking off personal protective equipment (PPE) in primary care

Gloves, aprons (and eye protection if used) should be taken off in the patient's room or cohort area.

1

Remove gloves. Grasp the outside of the glove with the opposite gloved hand; peel off. Hold the removed glove in the remaining gloved hand.



Slide the fingers of the un-gloved hand under the remaining glove at the wrist. Peel the remaining glove off over the first glove and discard.



2

Clean hands.



3

Apron. Unfasten or break open apron ties at the neck and let the apron fold down on itself.



Break ties at waist and fold apron in on itself - do not touch the outside - this will be contaminated. Discard.



4

Remove eye protection if worn. Use both hands to handle the straps by pulling away from face and discard.



5

Clean hands.



6

Remove face mask once your clinical work is completed.



Untie or break bottom ties, followed by top ties or elastic, and remove by handling the ties only. Lean forward slightly.



Discard.
DO NOT reuse once removed.



7

Clean hands with soap and water.



ANNEX 9 WASTE COLLECTION AND TRANSPORT

WITHIN A FIELD HOSPITAL

In field hospitals, safe and efficient waste collection and transport is essential to prevent infection risks, control odors and pests, and maintain hygienic care environments. Improper or mixed handling of waste, especially combining infectious with non-infectious waste, can dramatically increase waste treatment needs (or incineration volume), operational costs, and public health risks.

Collection principles

Following WHO and ICRC guidelines, waste should be collected at least once daily, with higher frequency in high-volume areas (e.g., wards, triage). The SCI EMT manual emphasizes that this routine must be pre-scheduled, supervised, and adjusted based on volume.

Key Practices:

- Segregate at source (responsibility of all staff)
- No manual sorting during collection (risk of contamination)
- Never compress or shake bags to reduce volume
- Do not overfill: Follow the "¾ full" rule for bags and boxes (procure enough waste bags)

Tools and equipment

Minimum Equipment Requirements:

Equipment	Use	Notes
Trolleys or carts	On-site waste transport	Should be leak-proof, easy to disinfect
Color-coded waste bags	Containment of waste at source	Yellow for infectious Black/grey for general
Sharps boxes	Contained transport of needles/blades	Closed and labeled; do not open after sealing
Sticky labels	Labelling infectious and hazardous waste bags	Printable format in Annex 2
PPE for waste handlers	Protection from splash/contact	Gloves, boots, aprons, masks, goggles

Recommended collection procedure

- Preparation
 - Check trolley and PPE.
 - Confirm collection schedule by zone.
 - Bring spare bags and sharps boxes as replacements.
- Collection
 - Empty non-infectious bins first (e.g., office, kitchen, packaging waste).
 - Then collect infectious and sharps waste using a separate trolley or route.
 - Tie bags securely without compressing.
 - Seal sharps boxes before removing.
- Transport
 - Move waste directly to the waste management zone via designated route.
 - Avoid passing through patient care areas when possible.
 - If transport must pass public or clinical spaces, use covered containers.
- Post-collection
 - Replace bags and clean bin surfaces with disinfectant.
 - Disinfect trolleys and PPE.

- Document anomalies (e.g., overfilled bins, mixed contents).

Roles and Responsibilities

Role	Responsibilities
Waste Handler / Cleaner	Follow scheduled routes Use PPE Collect separately by non-infectious and infectious streams Disinfect tools
WASH Supervisor	Train handlers Adjust frequency Inspect compliance
Clinical Lead / Nurses	Ensure proper segregation at ward level Reject misclassified bins
Logistics	Maintain trolley and PPE stock

ANNEX 10 HANDLING AND DISPOSAL OF LIQUID BODY FLUIDS FROM CONTAINERS

Containers such as urine bags, blood bags, and drainage pouches may hold large volumes of liquid infectious waste. These should **never be incinerated** without emptying, as enclosed fluids pose a risk of explosion during combustion. Proper emptying is therefore essential prior to disposal or treatment.

1. Disinfection and emptying procedure

Before emptying body fluids into any sanitation system, the liquid waste must be disinfected using a 1% chlorine solution to reduce the risk of pathogen transmission. This is particularly important for blood or visibly contaminated fluids.

Steps:

- 1 Wear appropriate PPE: heavy-duty gloves, apron, boots, and face shield.
- 2 Prepare 1% chlorine solution using:
 - Sodium hypochlorite (bleach): Dilute the available product to prepare 1% chlorine solution (calculations to be done by a WASH specialist).
- 3 Pour the fluid into a collection bucket containing the 1% chlorine solution.
- 4 Allow a minimum contact time of 30 minutes.
- 5 After disinfection, empty the contents into:
 - A soakaway pit or
 - A pit latrine or
 - A sanitary sewer, if locally available and allowed.

Do not discharge into open drains or natural waterways under any circumstances.

2. Disposal of the Empty Container

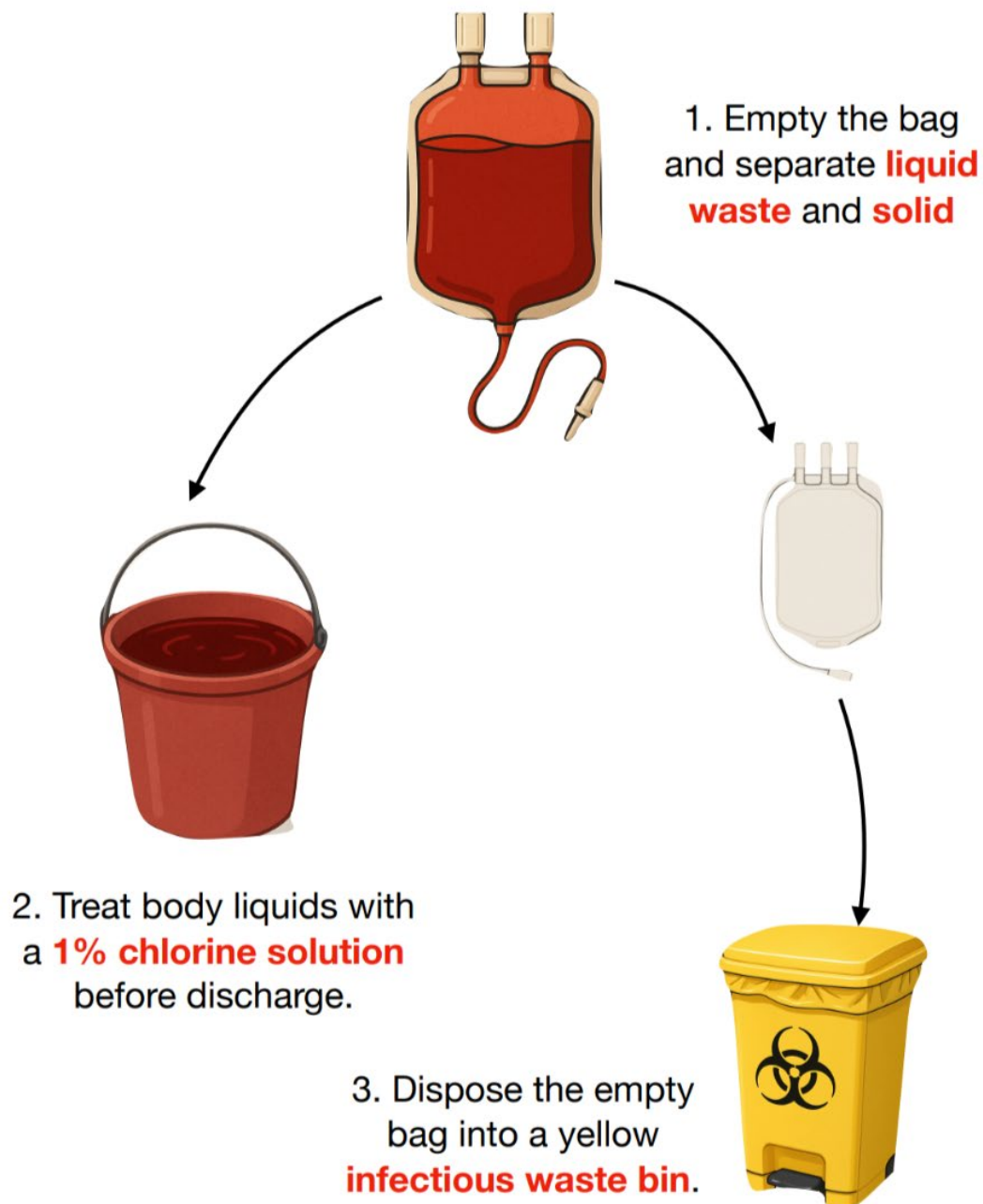
Once emptied and disinfected:

- If blood bag: place in yellow infectious waste bag for incineration.
- If urine bag: depending on local policy, dispose as either infectious or general waste, but do not reuse.
- All empty containers must be sealed in appropriate waste bags and transported to the waste zone for treatment.

These fluid bags are often made of PVC plastics. Follow the PVC waste policy of your organisation.

Disposal of Liquid Body Fluids from Containers

Do not incinerate full urine or blood bags because of the risk of explosion in the incinerator.



ANNEX 11 WASTE MANAGEMENT KIT

1. Waste Segregation Supplies

- Color-coded bins
 - With lids: Yellow for infectious, Green for food waste (or black with a lid??),
 - Without lids: Black for general waste
- Safety boxes for sharps
- Bin liners (ex: plastic bags yellow for infectious waste, black for general waste)
- Label stickers (Annex 2)
- Segregation reminder posters (Annex 10)

2. Personal Protective Equipment (PPE)

- Masks, preferably N95 (anti-particulate matter) or surgical
- Long gloves (reusable, waterproof and chlorine-resistant gloves)
- Safety goggles or face shields
- Waterproof and chlorine-resistant aprons
- Rubber boots
- Self protection reminder poster (Annex 7)

3. Transportation & Handling Tools

- Waste transport trolleys (easy to clean, labeled)
- Wheelbarrows (if trolleys unavailable)
- Cleaning/disinfection supplies

4. Onsite Treatment & Storage Infrastructure

- Small-scale incinerator (diesel fired)
- Encapsulation tanks
- Waste storage zone construction materials (shaded, ventilated)
- Fencing materials for incinerator area

5. Administrative & Monitoring Tools

- Waste management plan and SOPs (prepared by each organisation)
- Training manuals
- Logbooks for waste management (Annex 2)
- Data collection tools (paper tool in Annex 2)
- Weighing balance

ANNEX 12 WASTE BIN PLACEMENT STRATEGY

1. Always place bins at the point of waste generation

- "No more than 1 meter away from where the waste is generated."
- Avoid making staff walk across the tent or facility to dispose of waste: if it's not right there, it won't be used properly.
- Do not place the infectious waste bin next to a hand-wash sink: paper towels are often thrown into the nearest bin.
- Place all bins together (general, infectious, etc) so staff must make a decision each time.

2. Visibility and Signage

- Use posters directly above or behind bins.
- Include symbols and text on bins.
- Post reminders: "Do not mix!" or "Dispose at $\frac{3}{4}$ full."

3. Practical features

- Each infectious waste bin must have:
 - A lid (foot pedal preferred if available).
 - Color-coded liner matching the bin.
 - Label with symbols (WHO standard pictograms).
- Position bins against a wall or stable surface to avoid tipping.

4. Number and spacing

- For high-traffic zones, provide duplicate bin sets to avoid overflow.

5. Maintenance

- Train all staff to empty bins at $\frac{3}{4}$ full, not when overflowing.
- Establish a bin cleaning schedule (daily or as needed).
- Appoint a staff member to check bin placement daily for accessibility and proper use.



worm

Waste in humanitarian Operations:
Reduction and Minimisation



Funded by the
European Union