Preparation of National Health-Care Waste Management Plans in Sub-Saharan Countries

Guidance Manual

Secretariat of the Basel Convention
and
World Health Organization

WHO Library Cataloguing-in-Publication Data

Preparation of national health-care waste management plans in Sub-Saharan countries : guidance manual / Secretariat of the Basel Convention and World Health Organization.

1.Medical waste 2.Medical waste disposal 3.Waste management 4.Health policy 5.Policy making 6.Guidelines 7.Manuals 8.Africa South of the Sahara I.Secretariat of the Basel Convention II.World Health Organization.

ISBN 92 4 154662 X (NLM classification: WA 790)

The Secretariat of the Basel Convention/UNEP approves the joint publication of "Preparation of National Health-Care Waste Management Plans in Sub-Saharan Countries-Guidance Manual" in English and French with the World Health Organization.

UNEP ISBN: 92-1-158657-7

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Printed by the WHO Document Production Services, Geneva, Switzerland

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Abbreviations

HCF	:	Health-care facility
HCFs	:	Health-care facilities
HCW	:	Health-care waste
HCWM:	:	Health-care waste management
MoE	:	Ministry of Environment
MoH	:	Ministry of Health
NAP	:	National action plan
SBC	:	Secretariat of the Basel Convention
UNEP	:	United Nations Environment Programme
WHO	:	World Health Organization

Annexes

Foreword

The management of health care waste is an issue that is being looked upon from both a public health and an environmental point of view. Such different perspectives may lead to gaps in visions and understanding, and even definitions. This document has been elaborated jointly by the World Health Organization (WHO) and the Secretariat of the Basel Convention (SBC) to harmonize the different view-points, and develop a common approach for the preparation of national health care waste management plans, that address both the health and waste management dimensions. These guidelines have been reviewed by the Basel Convention Regional Centre for English speaking African countries, based in Pretoria, as well as the Basel Convention Regional Centre for French speaking African countries, based in Dakar.

The manual is the result of experience gathered over several years (2000-2004) in conducting technical assistance projects in a number of countries in the Sub-Saharan region. It aims at identifying appropriate practices for health care waste management by providing assessment and planning tools applicable in most sub-Saharan countries of Africa. The document is divided into four sections.

The *first section* contains fundamental information people involved in health care waste management at any level should be aware of; definitions, characterisation and classification of health care waste, associated risks and basic protective measures for employees, minimum observance that any health care facilities should comply with, key management principles, sound treatment and disposal technologies applicable to each category of waste.

The *second section* presents the actions that should be taken as a first step to assess the current situation before developing a national health care waste management plan. The relevance of such a plan and the implementation of realistic, practical and sustainable solutions, tuned to the needs of countries, depends on the accuracy of the initial assessment.

The *third section* provides guidance for the establishment of a national health care waste management plan. It describes how to develop plans according to specific objectives to be used by the planning officers of the central, regional and municipal Governments to improve all aspects of health care waste management. Complementary to the development of health care waste management through sets of specific objectives, a holistic approach is necessary to address efficiently all the specific aspects of such a plan.

Finally the *fourth section* provides guidance to develop a strategy to implement a health care waste management plan at national and regional levels. It is important and necessary, during the implementation phases, to reinforce the collaboration between the central, the regional and municipal authorities to improve the health care waste management practices and to find out pragmatic solutions for their sound disposal.

In addition, the reader is kindly encouraged to take due account of the following documents:

- The “Technical Guidelines on Environmentally Sound Management of Biomedical and Health-care waste” (2002) adopted by the Conference of the Parties to the Basel Convention;
- Safe management of wastes from health-care activities, WHO (1999);
- Teacher’s Guide: Safe management of wastes from health-care activities, WHO (1998);
- Guidance for the development and implementation of a National Action Plans, WHO (2004);
- Basic Steps in the Preparation of Health Care Waste Management Plans for Health Care Establishments, WHO-Regional Office for the Eastern Mediterranean (CEHA) (2002).

Fundamentals of health-care waste management

This section provides general information on HCW and key elements of management procedures that are essential to know before developing a HCWM plan. It includes the following:

- The need for the development of supervision and management structures;
- A presentation of the risks associated with HCW;
- A definition and a classification of HCW;
- The minimum observance that should be respected for HCWM;
- A guidance for the specific management of hazardous and infectious HCW;
- Indications for the development of protective measures for HCF staff and the environment.

1.1 Supervision and management structures for HCW

HCWM is first of all a *management* issue before being a technical one and therefore completely depend on the *commitment* of the entire staff within HCFs. This dedication will only be possible if people are first of all properly *trained* and made aware of the risks that this particular type of waste poses. It is therefore important to make sure the curricula of medical and para-medical staff includes this important public-health issue (see § 3.4 for further information).

When a new staff member is engaged, it is highly recommended that a specific clause regarding the safe management of HCW be included in the contract, so as to make the new employee fully aware of the importance of this part of his/her work and made liable in this respect.

To make sure HCW is properly managed on the long term, it is important to *supervise on a regular basis* the practices of the staff. This should be performed by the HCWM officer and/or members of a HCWM committee within each HCF (depending on the size of the facility). Typically members of such a committee are usually the same as those in charge of nosocomial infections. Appropriate on-going training and awareness sessions should be organized accordingly to keep practices at the best standards possible.

To support the HCWM officer and/or these HCWM committees, *regional and national support* should be provided (see § 4.2 for further details about the support structure). These regional and national management teams are there to supply the HCF level with the necessary technical backstopping to both ensure standard and harmonized procedures are applied and facilitate the daily work of the HCWM officer and members of the HCWM committees.

1.2 Risks associated with HCW

All individuals exposed to hazardous HCW are potentially at risk of being injured or infected. They include:

- *Medical staff*: doctors, nurses, sanitary staff and hospital maintenance personnel;
- *In- and out-patients* receiving treatment in health-care facilities as well as their visitors;
- *Workers in support services* linked to health-care facilities such as laundries, waste handling and transportation services;
- *Workers in waste disposal facilities*, including scavengers;
- The *general public* and more specifically the children playing with the items they can find in the waste outside the health-care facilities when it is directly accessible to them.

Supporting the Governments in the implementation of adequate procedures to minimise the overall risks associated with HCW management remains the prior objective of this Guidance Manual. Waste management and treatment options should first protect the health-care workers and the population and minimise indirect impacts from environmental exposures to HCW.

1.2.1 Occupational and public health risks

During handling of wastes, the medical and ancillary staff as well as the sanitary labourers can be injured if the waste has not been packed safely. In that respect*, sharps are considered as one of the most dangerous category of waste.* Many injuries occur because syringe needles or other sharps have not been collected in safety boxes or because these have been overfilled. On dumpsites, scavengers during their recycling activities may also come in contact with infectious waste if it has not been properly treated or disposed of.

The general public can be infected by HCW either directly or indirectly through several routes of contamination. Dumping HCW in open areas is a practice that can have major adverse effects on the population. The "recycling" practices that have been reported, particularly, the reuse of syringes is certainly the most serious problem in some of the developing countries. The WHO estimates that over 20 million infections of hepatitis B, C and HIV occur yearly due to unsafe injection practices (reuse of syringes and needles in the absence of sterilization)[1]. There is a risk for public health as regards the sale of recovered drugs in the informal sector and the lack of controls.

Illustration 1: When people are scavenging, the risk of needle stick injuries increases greatly

1.2.2 Indirect risks via the environment

Finally, the dumping of HCW in uncontrolled areas can have a direct environmental effect by contaminating soils and underground waters.

During incineration, if no proper filtering is done, air can also be polluted causing illnesses to the nearby populations. This has to be taken into consideration when choosing a treatment or a disposal method by carrying out a rapid environmental impact assessment.

Illustration 2: the soil and underground water can be contaminated with heavy metals and other toxic products that may enter the food chain…

1.3 Definitions and classification of health-care waste

Health-care waste includes all the wastes generated by medical activities. It embraces activities of diagnosis as well as preventive, curative and palliative treatments in the field of human and veterinary medicine. In other words, are considered as health-care waste all the wastes produced by a medical institution (public or private), a medical research facility or a laboratory.

[1] WHO Fact sheet n° 231, April 2002 (http://www.who.int/mediacentre/factsheets/fs231/en/)

As mentioned earlier, an effort to bring together medical staff with waste managers has been made by combining the environmentally and pragmatic oriented approach of the second with the public health safety concerns and principles of precaution of the first.

According to the Technical Guidelines on Environmentally Sound Management of Biomedical and Health-care waste provided by the Conference of the Parties to the Basel Convention on the Control of Trans-boundary Movements of Hazardous Waste and their Disposal (December 2002), health-care waste are classified as follows[2] (see figure 1):

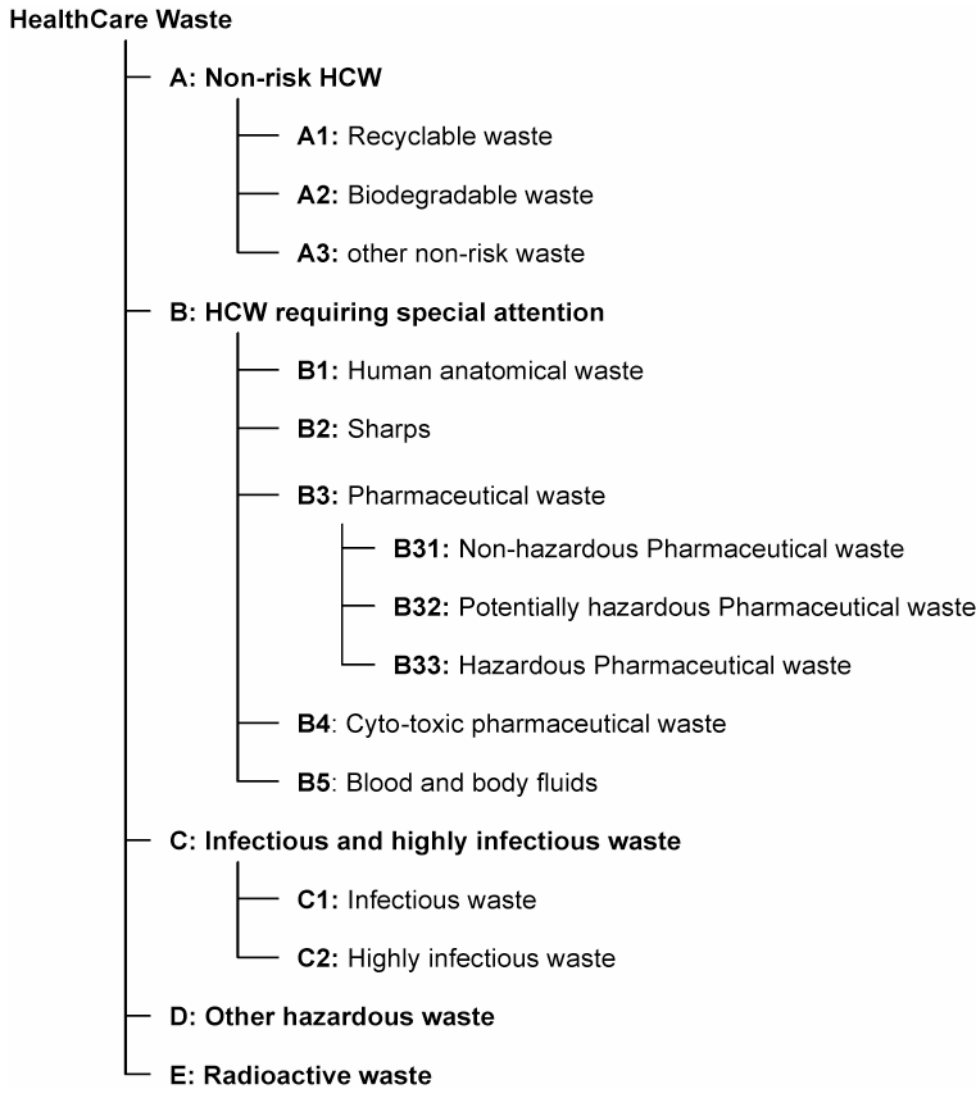

Figure 1: Classification of HCW

[2] The classification has been re-transcribed as such with two modifications only for the health-care waste of categories A and C. They have been divided into three and two classes respectively for practical but also "public-health safety" reasons to respect the most important aspects of the precautionary principals recommended by the WHO.

A Non-risk HCW

Non-risk HCW includes all the waste that has not been infected like general office waste, packaging or left over food. They are similar to normal household or municipal waste and can be managed by the municipal waste services. They represent between 75% and 90% of the total amount of HCW generated by medical institutions. Three groups can be established:

A1 Recyclable waste

It includes paper, cardboard, non-contaminated plastic or metal, cans or glass that can be recycled if any recycling industry exists in the country.

A2 Biodegradable HCW

This category of waste comprises for instance, left over food or garden waste that can be composted.

A3 Other non-risk waste

Are included in this category all the non-risk waste that do not belong to categories A1 and A2.

B Biomedical and health-care waste requiring special attention

B1 Human anatomical waste

This category of waste comprises non-infectious human body parts, organs and tissues and blood bags.

Examples of such wastes: tissue waste, removed organs, amputated body parts, placentas, etc…

B2 Waste sharps

Sharps are all objects and materials that are closely linked with health-care activities and pose a potential risk of injury and infection due to their puncture or cut property. For this reason, sharps are considered as one of the most hazardous waste generated in the HCF and they must be managed with the utmost care.

Examples of such wastes: all types of needles, broken glassware, ampoules, scalpel blades, lancets, vials without content

B3 Pharmaceutical waste

The term "pharmaceuticals" embraces a multitude of active ingredients and types of preparations. The spectrum ranges from teas through heavy metal containing disinfectants to highly specific medicines. Waste management therefore requires the use of a differentiated approach. This category of waste comprises expired pharmaceuticals or pharmaceuticals that are unusable for other reasons (e.g. call-back campaign). Pharmaceutical wastes are divided into three classes. Their management occurs in a class-specific manner (see below).

B31 Non-hazardous pharmaceutical waste

This class includes pharmaceuticals such as camomile tea or cough syrup that pose no hazard during collection, intermediate storage and waste management. They are not considered hazardous wastes and should be managed jointly with municipal waste.

B32 Potentially hazardous pharmaceutical waste

This class embraces pharmaceuticals that pose a potential hazard when used improperly by unauthorised persons. They are considered as hazardous wastes and their management must take place in an appropriate waste disposal facility.

B33 *Hazardous pharmaceutical waste*

Class B33 pharmaceutical waste comprises heavy metal containing and unidentifiable pharmaceuticals as well as heavy metal containing disinfectants, which owing to their composition require special management. They must be considered as hazardous wastes and their management must take place in an appropriate waste disposal facility.

B4 Cytotoxic pharmaceutical waste

Cytotoxic pharmaceutical wastes are wastes that can arise by use (administration to patients), manufacture and preparation of pharmaceuticals with a cytotoxic (antineoplastic) effect. These chemical substances can be subdivided into six main groups: alkylated substances, antimetabolites, antibiotics, plant alkaloids, hormones, and others. A potential health risk to persons who handle cytotoxic pharmaceuticals results above all from the mutagenic, carcinogenic and teratogenic properties of these substances. Consequently, these wastes pose a hazard, and the measures to be taken must also include those required by occupational health and safety provisions.

Examples of such wastes: Discernible liquid residues of cytotoxic concentrates, post-expiration-date cytotoxic pharmaceuticals and materials proven to be visibly contaminated by cytotoxic pharmaceuticals must be disposed of as cytotoxic pharmaceutical waste.

B5 Blood and body fluids waste

It includes wastes that are not categorised as infectious waste but are contaminated with human or animal blood, secretions and excretions. It is warranted to assume that these wastes might be contaminated with pathogens.

Examples of such wastes: Dressing material, swabs, syringes without needle, infusion equipment without spike, bandages

C Infectious and highly infectious waste

Infectiousness is one of the hazard characteristic listed in annex II of the Basel Convention and defined under class H6.2. Special requirements regarding the management of infectious wastes must be imposed whenever waste is known or – based on medical experience – expected to be contaminated by causative agents of diseases and when this contamination gives cause for concern that the disease might spread. In this category two groups can be considered depending on the degree of infectiousness that is expected.

C1 Infectious waste

This class comprises all biomedical and health-care waste known or clinically assessed by a medical practitioner or veterinary surgeon to have the potential of transmitting infectious agents to humans or animals. Waste of this kind is typically generated in the following places: isolation wards of hospitals; dialysis wards or centres caring for patients infected with hepatitis viruses (yellow dialysis); pathology departments; operating theatres; medical practices and laboratories which mainly treat patients suffering from the diseases specified above. It includes:

- Discarded materials or equipment contaminated with blood and its derivatives, other body fluids or excreta from clinically confirmed infected patients or animals with hazardous communicable diseases. Contaminated waste from patients known to have blood-borne infections undergoing haemodialysis (e.g. dialysis equipment such as tubing and filters, disposable sheets, linen, aprons, gloves or laboratory coats contaminated with blood);
- Carcasses as well as litter and animal faeces from animal test laboratories, if transmission of the above-mentioned diseases is to be expected.

Examples of such wastes: *Blood* from patients contaminated with HIV, viral hepatitis, brucellosis, Q fever. *Faeces* from patients infected with typhoid fever, enteritis, cholera. *Respiratory tract secretions* from patients infected with TB, anthrax, rabies, poliomyelitis…

C2 Highly infectious waste

It includes:

- All microbiological cultures in which a multiplication of pathogens of any kind has occurred. They are generated in institutes working in the fields of hygiene, microbiology and virology as well as in medical laboratories, medical practices and similar establishments;
- Laboratory waste (cultures and stocks with any viable biological agents artificially cultivated to significantly elevated numbers, including dishes and devices used to transfer, inoculate and mix cultures of infectious agents and infected animals from laboratories).

Examples of such wastes: Sputum cultures of TB laboratories, contaminated blood clots and glassware material generated in the medical analysis laboratories, high concentrated microbiological cultures carried out in medical analysis laboratories.

D Other hazardous waste

This category of waste is not exclusive to the health-care sector. They include: gaseous, liquid and solid chemicals, waste with high contents of heavy metals such as batteries, pressurized containers, etc…

Chemical waste consists of discarded chemicals that are generated during disinfecting procedures or cleaning processes. Not all of them are hazardous but some have toxic, corrosive, flammable, reactive, explosive, shock sensitive, cyto- or genotoxic properties. They must be used and disposed of according to the specifications provided with each type of chemical.

Waste with high contents of heavy metals and derivatives are potentially highly toxic. They are considered as a sub-group of chemical waste but should be treated specifically.

Pressurised containers consist of full or emptied containers or aerosol cans with pressurised liquids, gas or powdered materials.

Examples of such wastes: thermometers, blood-pressure gauges, photographic fixing and developing solutions in X-ray departments, halogenated or non-halogenated solvents, organic and in-organic chemicals.

E Radioactive health-care waste

Radioactive waste includes liquids, gases and solids contaminated with radionuclides whose ionizing radiations have genotoxic effects. The ionizing radiations of interest in medicine include X- and γ-rays as well as α- and β- particles. An important difference between these types of radiations is that X-rays are emitted from X-ray tubes only when generating equipment is switched on whereas γ-rays, α- and β- particles emit radiations continuously.

The type of radioactive material used in health-care facilities results in low level radioactive waste. It concerns mainly therapeutic and imaging investigation activities where Cobalt (^{60}Co), Technetium (^{99m}Tc), iodine (^{131}I) and iridium (^{192}Ir) are most commonly used.

Examples of such wastes: Radioactive waste includes solid, liquid and gaseous waste contaminated with radionuclides generated from in vitro analysis of body tissue and fluid, in vivo body organ imaging and tumour localisation, and investigative and therapeutic procedures.

1.4 Minimum observance for HCWM

The HCW that are generated within a HCF should always follow an appropriate and well-identified stream from their point of generation until their final disposal. This stream is composed of several steps that include: generation, segregation collection and on-site transportation, on-site storage, off-site transportation (optional), treatment and disposal of the HCW. This chapter provides basic information on these different steps, which are summarized in the figure 2, and presents the minimal procedures that should be respected in each of these steps[3].

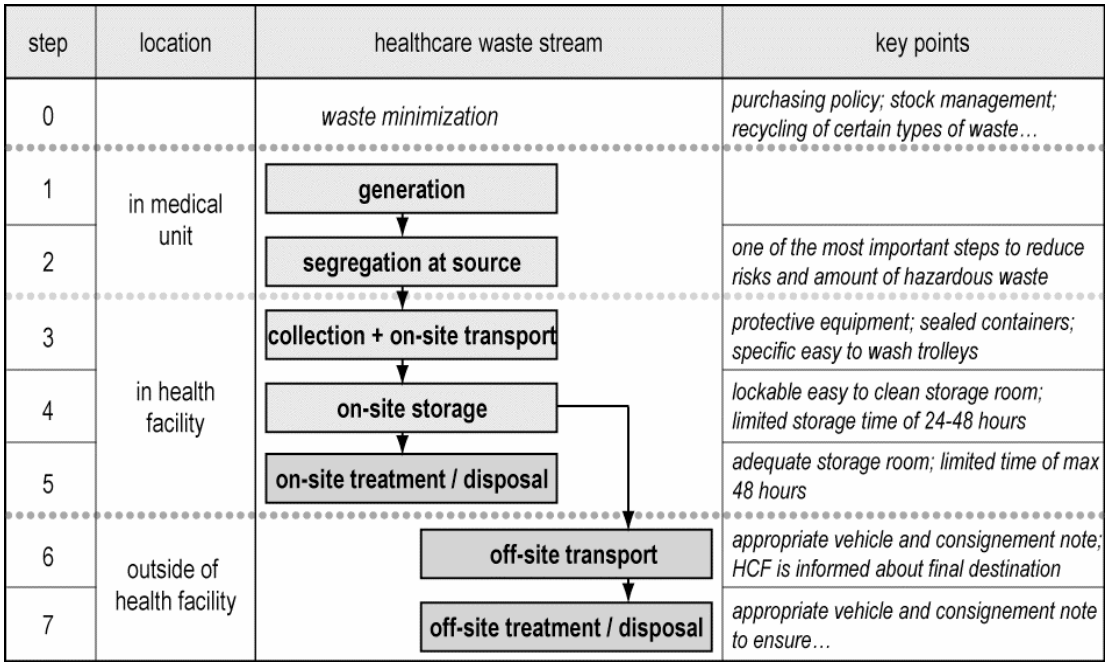

Figure 2: synopsis of the HCW stream

1.4.1 Generation of HCW

Medical activities generate waste that should always be discarded *at the point of use* by the person who used the item to be disposed of. The quantity of HCW generated should always be minimized and precautions must be taken during their handling.

Waste minimization and recycling

Before producing waste, it should be investigated whether the amount of waste generated could be minimized in order to reduce efforts in subsequent handling, treatment and disposal operations. The reuse of equipment has almost disappeared due to the marketing of single use items and the need to prevent the spread of nosocomial diseases. This is particularly the case for medical items such as syringe needles.

There are however other opportunities for recycling or reuse, in particular of objects / items which are not directly used for health-care (paper, cardboard, glass, metal containers, plastic wrappings…). One of the most efficient measures for waste reduction lies in the careful management of medical stocks in the hospital pharmacies.

Recycling of potentially contaminated items such as the plastic and metal from syringes/needles is not recommended for the moment in most Sub-Saharan countries due to the absence of availability of appropriate technologies, lack of specific training / awareness as well as adequate management procedures. Seeking information/experience from abroad is nevertheless encouraged as a way to prepare for future recycling processes.

[3] See also the « Technical Guidelines on Environmentally Sound Management of Biomedical and Health-care waste provided by the Conference of the Parties to the Basel Convention on the Control of Trans-boundary Movements of Hazardous Waste and their Disposal » (December 2002), chapter 7.

Minimal observance for waste minimization / recycling and waste handling
❑ Make sure infectious and hazardous HCW are properly segregated from general waste so as to reduce disposal costs and increase materials for recycling; ❑ Ensure a proper stock management of the pharmacies in the hospitals by using adequate delivery and stock position forms; ❑ Purchase durable equipment, furnishing and supply; ❑ Explore waste recycling options for food or garden waste such as composting.

1.4.2 Waste segregation

Segregation is one of the most important steps to successfully manage HCW.

Given the fact that only about 10-25% of the HCW is hazardous, treatment and disposal costs could be greatly reduced if a proper segregation were performed. Segregating hazardous from non-hazardous waste reduces also greatly the risks of infecting workers handling HCW. Actually, the part of the HCW that is hazardous and requires special treatment could be reduced to some 2-5% if the hazardous part were immediately separated from the other waste.

The segregation consists in separating the different waste streams based on the hazardous properties of the waste, the type of treatment and disposal practices that are applied. A recommended way of identifying HCW categories is by sorting the waste into colour-coded and well-labelled bags or containers.

All the specific procedures of HCW segregation, packaging and labelling should be explained to the medical and ancillary staff and displayed in each department on charts located on the walls nearby the HCW containers that should be specifically suited for each category of waste.

Segregation should:

- Always take place *at the source*, that is at the ward bedside, Operation Theatre, Medical Analysis Laboratory, or any other room or ward in the hospital where the waste is generated;
- Be *simple* to implement for the medical and ancillary staff and *applied uniformly* throughout the country;
- Be *safe* and guaranty the absence of infectious HCW in the domestic waste flow;
- Be *well understood and well known* by the medical and ancillary staff of the HCFs;
- Be regularly *monitored* to ensure that the procedures are respected.

<u>Colour coding system</u>

The application of a *colour coding system* (see table 1) aims at ensuring an immediate and non-equivocal identification of the hazards associated with the type of HCW that is handled or treated. In that respect, the colour coding system should remain simple and be applied uniformly throughout the country.

Black	Yellow	Brown
✓ non-risk waste of category A ✓ exceptionally, small quantity of waste of category B1 ✓ pharmaceutical waste of category B3, class B31 only	✓ special waste of categories B1, B2, B4, B5 ✓ infectious waste and highly infectious waste of categories C1 and C2 ✓ radioactive waste of category E	✓ pharmaceutical waste of categories B3, classes B32 and B33 ✓ category D such as chemicals, heavy metal wastes

Table 1: colour coding system for HCW

Labelling (see table 2)

All special HCW of categories B1, B4, B5, C1, C2 should be placed in yellow containers (preferably yellow polyethylene bags of minimum 300 microns gauge) marked and indicated with the international biohazard symbol. Preferably, the bags should be fixed in bag-holders. If not available, yellow bins could be used.

HCW of category B2 (sharps) should either be destroyed at source with special devices or placed in specific cardboard or plastic safety boxes puncture and leak-proof, designed so that items can be dropped in using one hand, and no item can be removed (see annexe 1). The safety boxes should always be coloured yellow, marked « Danger ! Contaminated sharps » and indicated with the Biohazard symbol. It shall be sealed and disposed of when three-quarters full.

Category	Labelling	International symbols
B1	« Danger ! Anatomical waste, to be incinerated or deeply buried »	
B2	« Danger ! Contaminated sharps, do not open »	
B4, B5, C1	« Danger ! Hazardous infectious waste »	
C2	« Danger ! Highly infectious waste, to be pre-treated »	
B32, B33, D	« Danger ! To be discarded by authorized staff only »	
E	« Danger ! Radioactive waste »	

Table 2: labelling of HCW containers

Radioactive HCW (category E) should be placed in yellow containers, sealed, marked and indicated with the international radioactive symbol as shown in the table above.

Minimal observance for waste segregation and labelling
❑ Establish a three-bin system with appropriate labelling in all the HCFs of the country as follow : 1) general HCW (black bags/bins; no symbol); 2) potentially infectious HCW (yellow bags/bins; biohazard symbol); 3) used sharps, including broken glass (yellow containers; biohazard symbol); ❑ Ensure awareness and training for medical staff and waste managers for waste segregation and labelling.

1.4.3 Collection and on-site transportation

In order to avoid accumulation of the waste, it must be collected on a regular basis and transported to a central storage area within the HCF before being treated or removed. The collection must follow specific routes through the HCF to reduce the passage of loaded carts through wards and other clean areas. The carts should be 1) easy to load and unload, 2) have no sharp edges that could damage waste bags or containers and 3) easy to clean.

Waste handling

Great care should be taken when handling HCW. The most important risks are linked with the injuries that sharps can produce. When handling HCW, sanitary staff and cleaners should always wear protective clothing including, as minimum, overalls or industrial aprons, boots and heavy duty gloves.

Minimal observance for waste collection and transportation
❑ Each HCF should have an HCWM plan which should include collection points and routes of waste transport. A timetable of the frequency of collection should also be set-up; ❑ Provide heavy duty gloves, industrial boots and apron for waste collectors; ❑ Ensure that waste containers are appropriately sealed, removed and replaced immediately when they are no more than three-quarters full; ❑ Ensure that hazardous / infectious HCW and non-risk HCW are collected on separate trolleys which should be marked with the corresponding colour (black/yellow) and washed regularly.

1.4.4 On-site storage

HCW are temporarily stored before being treated / disposed of on-site or transported off-site. A maximum storage time should not exceed 24 hours. Non-risk HCW should always be stored in a separate location from the infectious / hazardous HCW in order to avoid cross-contamination.

A storage facility, sized according to the volume of waste generated as well as the frequency of collection, must be found inside all HCFs. The facility should not be situated near to food stores or food preparation areas and its access should always be limited to authorised personnel. It should also be easy to clean, have good lighting and ventilation, and designed to prevent rodents, insects or birds from entering.

Minimal observance for on-site storage of HCW
❑ Ensure that a dedicated place, lockable and with no possibility for animals / insects to have access is designed to store hazardous / infectious HCW; ❑ Ensure that HCW isn't stored for more than 24 hours before being treated / disposed of.

1.4.5 Off-site transportation

Off-site transportation is required when hazardous HCW is treated outside the HCF. The waste producer is then responsible for the proper packaging and labelling of the containers that are transported. One of the reasons for labelling HCW bags or containers is that in case of an accident, the content can be quickly identified and appropriate measures taken. The labelling system should comply with the United Nations Recommendations and contain at least:

- The United Nations substance class (e.g. class 6, division 6.2, UN n° 3291 for infectious waste);
- The proper shipping name and the total quantity of waste covered by the description (by mass or volume);
- The date of collection.

The transportation should always be properly documented and all vehicles should carry a consignment note from the point of collection to the treatment facility. Furthermore, the vehicles used for the collection of hazardous / infectious HCW should not be used for any other purpose. They shall be free of sharp edges, easy to load and unload by hand, easy to clean / disinfect, and fully enclosed to prevent any spillage in the hospital premises or on the road during transportation.

Minimal observances for off-site transportation of waste
❑ Ensure that the responsible authorities always approve the off-site transportation plan before any transit occurs; ❑ Ensure that all categories of HCW are collected every second day at least; ❑ Ensure that each HCF practising off-site transportation is aware of the final destination of the HCW they produce.

1.4.6 Treatment and disposal

Each class of HCW require specific treatment, however, in order to be pragmatic, it is advisable to distinguish three major classes polarizing around 90 % of the biomedical waste production. These major categories could be:

- Waste sharps ;
- Infectious and cytotoxic wastes;
- Organic wastes (blood and body fluid wastes, human anatomical waste…).

Hazardous / infectious HCW can be treated to reach a level of hazard / infectiousness that is considered as acceptable. Thus, after treatment, they follow the non-risk HCW stream and are disposed of with the general solid waste. They can also be directly disposed of by incineration or in sanitary landfills. Detailed information on the advantages and the disadvantages of each treatment / disposal technologies are provided in annexe 2.

Hazardous / infectious HCW can be treated *on-site* (i.e. in the HCF itself) or *off-site* (i.e. in an other HCF or in a dedicated treatment plant).

On-site treatment

This option is often the only one possible in the rural HCFs of the primary sector but on-site treatment can be also carried out for HCW generated in major HCFs. On-site treatment facilities are particularly appropriate in areas where hospitals are situated far from each other and the road system is poor.

The advantages of providing each health-care establishment with an on-site treatment facility includes convenience and minimization of risks to public health and the environment by confinement of hazardous / infectious HCW to the health-care premises. However, the treatment costs may be high if there are many hospitals: extra technical staff may be required to operate and maintain the facilities and it may be difficult for the relevant authorities to monitor the performance of many small facilities. This may result in poor compliance with operating standards, depending on the type of facilities, and increased environmental pollution.

Off-site treatment

The HCW generated in a HCF can be treated off-site, when centralized regional facilities exist. Although off-site treatment increases dependency of the HCF on an external actor and requires a fine-tuned transportation system, it provides the following advantages:

- Hospitals will not have to devote time and personnel to manage their own installations;
- Efficient operation can be more easily ensured in one centralized facility than in several plants where skilled workers may not be readily available;
- Greater cost-effectiveness for larger units, through economies of scale;
- Future modifications or expansions (relating to flue-gas cleaning systems of incinerators, for example) are likely to be less expensive;
- Where privatization of facilities is seen as a desirable option, this can be achieved more easily on a regional basis than for numerous small units;

- It will be easier for the relevant government agencies to supervise and monitor the facilities;
- Air pollution may be more easily kept to a minimum at a centralized plant (costs of monitoring and surveillance as well as flue-gas cleaning, for example, will be reduced);

Minimal observances for waste treatment and disposal
❑ Ensure that the most hazardous HCW (i.e. sharps) and (highly) infectious waste are properly treated and disposed of in all HCFs of the country; ❑ Ensure that treatment / disposal options that will be recommended in the National HCWM plan will be homogeneously applied in the country; ❑ Ensure that the selected options will be compatible with the local operation and maintenance capacities; ❑ Always select the most environmental friendly options taking into consideration the operation and maintenance costs.

1.5 Guidance for HCWM per category of waste

A (non-risk HCW)

Non-risk HCW, if well segregated, can be disposed of with the domestic waste. Depending on the quantities of this category of waste, it might be worth investigating ways of recuperating/recycling items such as paper and cardboard as well as plastic and metal cans that come from the administration and kitchen. Left-over food from the kitchen as well as garden waste (leaves, etc) can be recycled into valuable compost.

B1 (human anatomical waste)

It is primarily for ethical reasons that special requirements must be placed on the management of waste human body parts, organs and tissues. The waste must be collected in appropriate containers or bags as soon as possible at the place where it is generated. It must be kept in tight receptacles and under stable low temperature (5-8°C) conditions when stored temporarily for a prolonged period of time. Intermediate storage takes place at a location that is accessible only to trained personnel (in general the mortuary).

Normally, the waste must always be incinerated completely in an appropriate facility. Household waste incineration plants are, as a rule, not suitable for the incineration of amputated body parts, removed organs and placentas. Crematoria are usually used to dispose of amputated body parts. When cremation (or incineration) isn't possible/acceptable, waste can be buried in a dedicated area.

Exemptions and special provisions

Where only small quantities of these wastes are generated (e.g. in medical practices), they can be collected in appropriate containers and managed jointly with the municipal waste.

B2 (sharps)

Sharps require that measures be taken to prevent injury and infection during their handling within and outside of the HCFs. They have to be collected and managed separately from the other categories of HCW: the collection containers (safety boxes) must always be puncture and leak-proof.

The storage of sharps to be disposed of should always take place at a location that is accessible only to trained personnel. Once the safety boxes are sealed, they can be disposed of with the other infectious waste depending on the type of disposal technology that is selected. For more information refer to annexes 1 and 2.

Special provisions for needles and syringes

All *disposable syringes and needles* must be discarded of immediately following use. Syringes even without needles must be considered as unsafe. Needles should never be recapped. In addition, under no circumstances are used syringes or needles, or safety boxes, to be disposed of in normal garbage or dumped randomly without prior treatment.

Two possibilities currently exist to dispose of needles and syringes:

- They can be collected in safety boxes that are then disposed of with the infectious HCW if the disposal/treatment technologies are suitable: incineration or encapsulation are in general the adequate treatment technologies (cf. annexe 2). This option is certainly the safest since it minimizes the handling of the syringe and the needle. Other options include shredding and autoclaving;
- They can also be "treated on the spot". The treatment consists either in destroying the needle using a needle destroyer or separating the needle from the syringe using a device where the needle drops directly in a puncture-proof container (cf. annexe 1).

B3 (pharmaceutical waste)

Pharmacy department stores in each HCF should be rigorously managed to reduce the generation of pharmaceutical waste. Especially, stocks of pharmaceuticals should be inspected periodically and checked for their durability (expiration date). Stock positions should be recorded on a regular basis.

While pharmaceutical wastes of class B31 can be managed jointly with municipal waste, pharmaceutical wastes of classes B32 and B33 should be considered as hazardous and their management should take place in an appropriate waste disposal facility. Ideally, they should be returned to a national central collection point to ensure they are properly neutralized. Alternatively and only if the return cannot be ensured, an inertization[4] technique may be used and the inerted waste disposed of in a sanitary landfill.

B4 (cytotoxic pharmaceutical waste)

The risks posed by cytotoxic pharmaceuticals are primarily of relevance for persons who come into contact with them during preparation and during or after their use. It has long been common practice in hospitals that the number of persons who come into contact with these products is small. Specific guidance on this is available[5]. These wastes usually arise at central locations, i.e. in pharmacies and laboratories and they are also often found at places where the ready-to-use cytotoxic solutions are prepared.

The precautions taken during the use of cytotoxic pharmaceuticals must also be applied on their journey outside the respective establishment, as releases of these products can have adverse environmental impacts. The management of these wastes, in covered and impermeable containers, must therefore be strictly controlled. Solid containers must be used for collection. The use of coded containers is recommended. For reasons of occupational safety, cytotoxic pharmaceutical wastes must be collected separately from pharmaceutical waste and disposed of in a hazardous waste incineration plant.

B5 (blood and body fluids waste)

Special requirements must be imposed on the management of this category of waste from the point of view of infection prevention in and outside the HCFs. Double bags or containers made of strong and leak-proof material are used for the collection of these wastes.

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4 Inertization consists in mixing pharmaceutical waste with cement and lime in a container before burying to minimise the risk that toxic substances migrate into the surface or groundwater. The packaging should previously be removed.

5 Cf for instance, *Safe management of waste from health-care activities*. Edited by Prüss, Giroult and Rushbrook, WHO. 1999.

If a household waste incineration plant is available or a *controlled* sanitary landfill site exists, this waste can be disposed of with the general domestic waste. However, in the Sub-Saharan context, this category of waste should be disposed of with the HCW of category C1 (infectious waste) since no proper household waste incineration plant or controlled sanitary landfill currently exists in the country.

C1 (infectious waste)

Infectious wastes must be collected in leak-proof containers carefully sealed and transported to a central storage facility/delivery point in a way that precludes direct contact. They must either be incinerated or be disinfected prior to final disposal using a recognized method, preferably treatment with saturated steam (autoclaving). Disinfected wastes may be disposed of in the same way as domestic waste. The disinfection plants must be operated under the operating parameters prescribed for waste disinfection, and this mode of operation must be documented and controlled.

If autoclaving is the selected option for infectious waste treatment, the efficiency of the vapour disinfection plant must be verified by a recognized institution when the plant is first put into operation and at regular intervals thereafter (e.g. twice a year), using appropriate microbiological indicators.

Exemptions and special provisions

Body fluids and excreta of infected patients with hazardous communicable diseases can be discharged to the sewerage system if there is a strict separation between the waste and drinking water installations and the sewerage system is connected to a wastewater treatment plant. In other cases, the body fluids and excreta have to be disinfected before being discharged to the sewerage system. Exceptionally, infectious waste can be disposed of by using a special area in a controlled landfill if there is no risk of contamination of ground or drinking water and the infectious waste is directly covered with earth or other material.

C2 (highly infectious waste)

Some medical areas produce HCW that can reasonably be suspected to be contaminated with highly contagious pathogens. Such sources include: all laboratory samples containing body fluids, tissues or faecal stools; isolation wards; and medical research facilities handling class 3 or higher pathogens.

Waste from these sources should always be pre-treated at source and then placed into yellow bags before joining the waste stream within the hospital. Autoclaving at a temperature of 121°C at 1-1.5 bars for at least 20 minutes should be the selected pre-treatment option. However, if a *distinct* autoclave is not available at source to ensure a thermal treatment, highly infectious waste can be disinfected in a concentrated 2% solution of sodium hypochlorite and left overnight before being discarded in a specific yellow bag properly sealed and itself discarded with the infectious HCW of category C1.

D (other health-care waste)

Large quantities of *chemicals* should be returned to the supplier for adequate treatment. Considering that there is currently a lack of appropriate treatment facilities for chemicals in most of the Sub-Saharan countries of Africa, on-site disposal must therefore be foreseen. In such circumstances, non-corrosive and non-flammable chemicals may be encapsulated separately to avoid unwanted chemical reactions after neutralisation.

Waste with high contents of *heavy metals* should normally be treated in specific recycling/ treatment facilities. Alternatively, as for chemical waste, it may be encapsulated. Waste with high contents of heavy metals, in particular mercury or cadmium, should never be incinerated.

E (radioactive waste)

With the noticeable exception of Cobalt (^{60}Co), their half-life is reasonably short (6 hours for ^{99m}Tc, 8 days for ^{131}I and 74 days for ^{192}Ir) and the concentrations used remain low. A proper storage with an appropriate retention time is sufficient to allow decay to background level. Radioactive waste should be placed in large containers or drums and labelled with the radiation symbol showing the radionuclide activity on a given date and the period of storage required.

Containers or tanks with radioactive waste that has not yet decayed to background level, should be stored in a specifically marked room with thick concrete walls (minimum 25 cm).

Non-infectious radioactive waste, which has decayed to background level, should follow the non-risk HCW stream while *Infectious radioactive waste*, which has decayed to background level, should follow the infectious HCW stream. *Liquid radioactive waste* should be discharged into the sewerage system or into a septic tank only after it has decayed to background level in buffer tanks.

1.6 Development of awareness and protective measures for HCF staff and the environment

Management of HCW is an integral part of hospital hygiene and infection control. Infectious HCW contributes to the risk of nosocomial infections, putting the health of medical staff and patients at risk. Proper HCWM practices should therefore be strictly followed as part of a comprehensive and systematic approach to hospital hygiene and infection control. A range of measures should be developed in relation with the handling and the treatment/disposal of HCW to promote personal hygiene and protective measures. These measures should also concern municipal staff operating in solid waste management at the city level. This chapter develops basic guidance that should be respected to limit the risks of injury/contamination linked to the management of hazardous/infectious HCW.

1.6.1 Personal hygiene

Basic personal hygiene is important in reducing the risks that occur from handling HCW. Hospital administrators and planning officers should ensure that washing facilities are made available to people handling HCW. This is particularly important at storage and treatment facilities.

One of the most basic measures for the maintenance of hygiene, and one that is particularly important in the hospital environment, is cleaning. As the hands are the most frequent vectors of nosocomial infections, hand hygiene is the primary preventive measure. Thorough hand washing with adequate quantities of water and soap removes more than 90% of micro-organisms encountered on the hands. However, the efficacy of the cleaning process depends completely on this mechanical action, since neither soap nor detergents possess any antimicrobial activity and can be counterproductive if is done too superficially. Cleaning has therefore to be carried out in a standardized manner.

1.6.2 Immunisation

Staff handling HCW should be offered appropriate immunization, including hepatitis B and tetanus. As HCW are often found in municipal solid waste municipal staff should also be offered this immunisation.

1.6.3 Personal protection

As already mentioned, staff which are in contact with HCW should wear the following personal protective clothing:

- Suitable heavy-duty gloves when handling HCW containers;
- Safety shoes or industrial boots to protect the feet against the risk of containers being accidentally dropped;
- Industrial apron or leg protectors when container handling could cause wounds.

1.6.4 Training and information

To be effective, a HCWM policy has to be applied carefully, consistently and universally. Training is a crucial aspect to successfully upgrade HCWM practices. The overall aim of training is to develop awareness of the health, safety, and environmental issues relating to HCWM. It should highlight the

roles and responsibilities of each actor involved in the management process of the HCW (duty of care).

Employees to be trained

Separate but equally important training programs should be designed for the following categories of personnel: 1) hospital managers and administrative staff responsible for implementing regulations on HCWM, 2) medical doctors; nurses and assistant nurses, 3) cleaners, porters, ancillary staff, and waste handlers, 4) municipal solid waste labourers and waste pickers.

Content

Staff education programmes should cover:

- Information on, and justification for, all aspects of the HCWM policy;
- Information on the role and responsibilities of each hospital staff member in implementing the policy;
- Technical instructions, relevant for the target group, on the application of waste management practices;
- Information on monitoring techniques.

1.6.5 Procedures in case of accidents and spillages

In HCFs, spillage is probably the most common type of emergency involving infectious or other hazardous material or waste. Response procedures are essentially the same regardless of whether the spillage involves waste or material in use, and should ensure that:

- Contaminated areas are cleaned and, if necessary, disinfected;
- Exposure of workers is limited as much as possible during the clearing up operation;
- The impact on patients, HCF staff and the environment is as limited as possible.

One person should be designated as responsible for the handling of emergencies, including coordination of actions, reporting to managers and regulators. Staff should be trained for emergency response, and the necessary equipment should be readily available at all times to ensure that all required measures can be implemented safely and rapidly. Written procedures for the different types of emergencies should be drawn up.

Spillages usually require that only the contaminated area be cleaned-up. For spillages of infectious material, however, it is important to determine the type of infectious agent; in some cases, immediate evacuation of the area may be necessary. In general, the more hazardous spillages occur in laboratories rather than in HCF departments.

Special provision for needle stick injuries

Due to their high potential for injuries and contamination, needles are one of the most dangerous items that are handled in a HCFs. Any accident should be reported to the infection control nurse and a reporting system should be established in each HCF. This information should then be reported to the competent authorities at central level.

Cuts with sharps or needle stick injuries should always be immediately disinfected. It is highly recommended to perform blood tests after such an injury to ensure that the person has not been contaminated by any pathogen, in particular hepatitis B and C or HIV.

1. **Evacuate** the contaminated area.
2. **Decontaminate** the eyes and skin of exposed personnel immediately.
3. **Inform** the designated person who should coordinate the necessary actions.
4. Determine the **nature** of the spill.
5. **Evacuate** all the people not involved in cleaning up.
6. Provide **first aid** and medical care to injured individuals.
7. **Secure** the area to prevent exposure of additional individuals.
8. Provide adequate **protective clothing** to personnel involved in cleaning-up.
9. **Limit** the spread of the spill.
10. **Neutralize or disinfect** the spilled or contaminated material if indicated.
11. **Collect** all spilled and contaminated material. [**Sharps should never be picked up by hand**; brushes and pans or other suitable tools should be used]. Spilled material and disposable contaminated items used for cleaning should be placed in the appropriate waste bags or containers.
12. **Decontaminate or disinfect** the area, wiping up with absorbent cloth. The cloth (or other absorbent material) should never be turned during this process, because this will spread the contamination. The decontamination should be carried out by working from the least to the most contaminated part, with a change of cloth at each stage. Dry cloths should be used in the case of liquid spillage; for spillages of solids, cloth impregnated with water (acidic, basic, or neutral as appropriate) should be used.
13. **Rinse** the area, and wipe dry with absorbent cloths.
14. Decontaminate or disinfect any tools that were used.
15. Remove protective clothing and decontaminate or disinfect it if necessary.
16. **Seek medical attention** if exposure to hazardous material has occurred during the operation.

Box 1: Example of general procedures to be followed in case of spillages
[source: *safe management of health-care waste*, WHO 1999]

2 Guidance to conduct a national sector assessment

The development of a national HCWM plan should be strongly supported by both the Ministries of Health and Environment who should provide institutional, financial, technical and logistical support to a *National Steering Committee for HCWM* that should be set-up first to conduct/coordinate the national sector assessment and the to implement the HCWM plan. A suggested flow chart of the organisation of this Committee is provided in section 4.

The development of a national HCWM plan must be based on a careful initial assessment. In order to propose realistic actions / solutions it is indispensable to have a clear understanding of political context showing how the responsibilities are shared between the state/regional authorities as well as between the MoH and MoE. Furthermore, the assessment should take into account the social, cultural and economical context of the country. Sufficient general and specific information on the health and waste management sectors must be gathered during the assessment.

The initial assessment aims at identifying the most problematic issues (e.g. disposal of sharps) and prioritizing the actions (urgent, short-term, medium or long-term) of the National HCWM Plan. In other words, the initial assessment aims at distinguishing actions that should be addressed in the HCWM plan; these actions must be presented as a part of a more global framework.

During the assessment, it is particularly important to understand the role and the involvement of the main actors and stakeholders in the HCWM process in order to identify those susceptible to support and implement the actions contained in the Plan.

To carry out the national sector assessment, the *rapid assessment tool* jointly developed by the WHO[6] and SBC/UNEP can be used. The compilation and analysis of data collected at national level can be done using the rating system (tool F) that is found in the *rapid assessment tool*. Alternatively a simplified version of this tool, specifically designed for Nigeria and presented with the inventory questionnaires in annexe 6 can be used.

The preliminary assessment should always focus on five main fields of activities that are summarized in figure 4.

n°	aspects to be assessed	rationale
1	**inventory the existing HCFs**	*fundamental for relevance of field analysis; use standard questionnaire (see annexe 6)*
2	**analyse the legislation and regulations**	*backbone of any HCWM plan at national level; compile and analyse existing (by-)laws*
3	**characterise the HCW production**	*indispensable for proper budgeting and choice of treatment equipment; helps prioritize areas*
4	**characterise the HCWM practices**	*only way to evaluate and prioritize what should be done in terms of training for all HCF staff*
5	**analyse the institutional and monitoring capacities**	*fundamental to ensure the sustainability of the HCWM system and its' potential for progress*

Figure 3: assessing the situation

[6] This tool, specifically developed for low income countries, can be requested at the WHO headquarters in Geneva hcwaste@who.int or can be directly downloaded from the website www.healthcarewaste.org at the bottom of the *on-line documents* section.

2.1 *Conduct an inventory of the existing HCFs*

Prior to any survey or action, the central Government has to collect / up-date basic information on all HCFs existing in the country. This information is essential for the development of the future HCWM plan and for the extrapolation of the results of the initial assessment based on a randomly selected sample of HCFs that will have to be surveyed in details (see annexe 5 for further details).

The sample should be representative of the different categories of HCFs found in the country. Therefore it is necessary to compile data on the HCFs in the country according to their category (public or private; central, regional or local) in all regions / provinces of the country in order to:

- Properly quantify the amount of HCW produced in the different health establishment categories and in the different regions / provinces;
- Characterise the HCWM practices per category of HCF;
- If the human and financial resources available to carry out the inventory aren't sufficient to carry out an extensive survey, a priority should be put on urban areas due to their high concentration of HCFs and therefore of HCW produced;
- Rural areas usually present relatively similar categories and quantities of waste produced as well as comparable HCWM practices. The number of HCFs visited in these areas can therefore be reduced in comparison to urban settings.

2.1.1 *Checklist of actions*

- ❑ Design an officer responsible for the coordination of the inventory of the existing HCFs;
- ❑ Establish a questionnaire to be distributed in each of the municipal Health Authorities;
- ❑ Compile and analyse the data;
- ❑ Share the information with the municipal and regional Authorities, with the other National Services and the main stakeholders involved in the country.

2.1.2 *Recommendations*

The questionnaire should enable to:

- Collect the total number of HCFs per category, the total number of beds and the average occupancy rate for each HCF;
- Get the state health-care budget and the amount that is currently dedicated to HCWM;
- Gather information on the collection and treatment / disposal equipments currently in place in the different HCFs.

REGION	District	HOSPITALS								HEALTH CENTRES							
		Government		Voluntary		Private		TOTAL		Government		Voluntary		Private		TOTAL	
		Nb	Beds	Nb	Beds	Nb	Beds	Nb	Beds	Nb	Beds	Nb	Beds	Nb	Beds	Nb	Beds
KAGERA		**1**	**250**	**10**	**1'452**	**0**	**0**	**11**	**1'702**	**10**	**311**	**7**	**290**	**2**	**29**	**19**	**630**
	Bukoba Urba	*1*	*250*	*0*	*0*	*0*	*0*	*1*	*250*	*1*	*0*	*0*	*0*	*1*	*9*	*2*	*9*
	Bukoba Rura	*0*	*0*	*1*	*140*	*0*	*0*	*1*	*140*	*2*	*56*	*3*	*230*	*0*	*0*	*5*	*286*
	Karagwe	*0*	*0*	*3*	*360*	*0*	*0*	*3*	*360*	*2*	*80*	*1*	*60*	*0*	*0*	*3*	*140*
	Muleba	*0*	*0*	*3*	*542*	*0*	*0*	*3*	*542*	*0*	*55*	*3*	*0*	*0*	*0*	*3*	*55*
	Biharamulo	*0*	*0*	*1*	*160*	*0*	*0*	*1*	*160*	*3*	*60*	*0*	*0*	*0*	*0*	*3*	*60*
	Ngara	*0*	*0*	*2*	*250*	*0*	*0*	*2*	*250*	*2*	*60*	*0*	*0*	*1*	*20*	*3*	*80*
MWANZA		**5**	**785**	**5**	**1'673**	**2**	**92**	**12**	**2'550**	**22**	**1'190**	**3**	**98**	**3**	**75**	**28**	**1'363**
	Mwanza	*1*	*170*	*1*	*986*	*2*	*92*	*4*	*1'248*	*1*	*45*	*2*	*95*	*3*	*75*	*6*	*215*
	Geita	*1*	*160*	*0*	*0*	*0*	*0*	*1*	*160*	*5*	*123*	*0*	*0*	*0*	*0*	*5*	*123*
	Kwimba	*1*	*105*	*1*	*244*	*0*	*0*	*2*	*349*	*2*	*60*	*0*	*0*	*0*	*0*	*2*	*60*
	Missungwi	*0*	*0*	*1*	*166*	*0*	*0*	*1*	*166*	*3*	*75*	*0*	*0*	*0*	*0*	*3*	*75*
	Magu	*1*	*150*	*1*	*70*	*0*	*0*	*2*	*220*	*4*	*100*	*0*	*0*	*0*	*0*	*4*	*100*
	Sengerema	*0*	*0*	*1*	*207*	*0*	*0*	*1*	*207*	*4*	*33*	*1*	*3*	*0*	*0*	*5*	*36*
	Ukerewe	*1*	*200*	*0*	*0*	*0*	*0*	*1*	*200*	*3*	*754*	*0*	*0*	*0*	*0*	*3*	*754*
MARA		**3**	**453**	**4**	**463**	**0**	**0**	**7**	**916**	**12**	**197**	**4**	**104**	**2**	**50**	**18**	**351**
	Musoma Urb	*1*	*226*	*0*	*0*	*0*	*0*	*1*	*226*	*1*	*0*	*0*	*0*	*0*	*0*	*1*	*0*
	Musoma Rur	*1*	*66*	*0*	*0*	*0*	*0*	*1*	*66*	*2*	*52*	*0*	*0*	*0*	*0*	*2*	*52*
	Bunda	*0*	*0*	*2*	*189*	*0*	*0*	*2*	*189*	*3*	*39*	*0*	*0*	*0*	*0*	*3*	*39*
	Serengeti	*0*	*0*	*1*	*124*	*0*	*0*	*1*	*124*	*2*	*34*	*0*	*0*	*0*	*0*	*2*	*34*
	Tarime	*1*	*161*	*1*	*150*	*0*	*0*	*2*	*311*	*4*	*72*	*4*	*104*	*2*	*50*	*10*	*226*

Figure 4: example of a national inventory of HCFs

2.2 Analyse the national legislations and the internal HCF rules

The legislative provisions constitute the backbone of the HCWM plan at national level since it enables to define clearly the duties and responsibilities of each actor involved in the HCWM process, at central, regional and local levels. The existing legislation related to HCWM, environmental protection and solid waste management as well as infection control within HCFs should be carefully analysed before undertaking any action.

Checklist of actions 2.2.1

- ❑ Design an officer responsible for the identification and the review of the legislation;
- ❑ Compile all the laws and by-laws that have been established at central and local levels;
- ❑ Make an inventory of the rules and regulations which may exist within HCFs related to hygiene of the premises and duties of (non)medical staff concerning HCWM;
- ❑ Analyse and formulate objectives according to § 4.1

2.2.2 Recommendations

Analyse carefully:

- Whether the legislation ensures health protection;
- What are the provisions regarding duties and responsibilities of the stakeholders and more specifically how could be developed a practical legislation to ensure a good balance between responsibilities of the central and the regional / local Governments;
- How the legislation should be reinforced to impulse a real change in the HCWM practises in the HCFs of the country.

2.3 Characterize the HCW production nationwide

In order to be able to design correctly the treatment plants or the disposal facilities and evaluate correctly the equipment and financial needs, it is essential to quantify the HCW production at the country and regional/provincial level. The knowledge of the quantities of HCW produced per province enables also to identify the most problematic ones that should receive a priority support from the central Government for the management of their HCW. As treatment is related to the type and quantities of HCW generated, it is important to consider the categorization of HCW in order to prioritise the most problematic issues by province/region. Actually, the knowledge of the daily production of hazardous HCW enables to:

At HCF level	At municipal, district, regional, provincial levels	At national level
1) Quantify the daily needs for waste collection and handling equipment/ material (yellow plastic bags, sharp boxes, trolleys, storage containers) 2) Plan the financial and human resources necessary to ensure a safe HCWM system; 3) Size the treatment and disposal facilities if the HCW is treated on-site.	1) Estimate the needs for the transportation equipment (number and capacity of the collection vehicles, number of shuttles to be organized); 2) Size the treatment / disposal plant (when a centralized system is considered); 3) Assess the environmental impact associated with the disposal of the hazardous HCW generated by the HCFs located in the area that is considered.	1 Follow-up and rank the production in each district / region / province in order to determine a strategy for the implementation of the HCWM plan; 2 Estimate and budget the annual quantities of collection and handling equipment needed for each category of HCF; 3 Control and monitor the streams of hazardous HCW generated in each hospital to ensure that they are safely disposed of.

2.3.1 Checklist of actions

- ❑ Design an officer responsible for the supervision/coordination of the inventory of the HCW and the characterisation of the HCWM practices;
- ❑ Select randomly a sample of HCFs (of all categories) in each province and carry out an inventory in each of them using an inventory form (see annexes 5 and 6);
- ❑ Analyse the data and extrapolate to estimate: 1) the daily production of HCW generated at country level (kg/bed/day) according to the type of health-care facility and, 2) the total daily production (kg) per region and nationwide for the hazardous and infectious HCW, sharps and non-risk HCW.
- ❑ For sharps, crosscheck the estimations with the average daily number of sharps issued by the Central Pharmacies (if they exist).

2.3.2 Recommendations

In order to get pertinent figures:

- A careful statistical sampling strategy, using stratification, should be applied to randomly select the HCFs (see annexe 5);
- The inventories must be carried out in the selected HCFs during one full week once during the dry season and then again during the rainy season;
- The figures obtained should be extrapolated taking into account the expected population growth rate, to help determine the capacity of the treatment facilities to be installed as well as other equipment necessary for the adequate management of HCW. Anticipating future needs is part of the planning process.

The example below taken from Tanzania shows one of the ways of estimating the quantities of HCW generated in HCFs and how the results can be used to get both a global picture at national level that will be useful for overall planning and budgeting as well as a breakdown per region to hierarchize them in terms of percentage of total production of HCW, thus helping to set priority areas for the implementation of the plan.

Estimation Methodology

The production of hazardous HCW was calculated in each medical institution by estimating the number of containers (bags, rubbish bins) used for medical waste collection during a defined period of time. The discussions with the medical and paramedical staff (nurses, nursing-assistants and technical services) enabled to adjust the total volume of waste collected by using a filling rate for each category of container. Finally, a volumetric mass ratio was applied (0,30 kg/l) according to the type of waste thrown into the container in order to estimate the total weight of clinical waste generated. The figure obtained is then divided by the total number of beds and the occupancy rate to estimate the quantity of medical waste generated per occupied bed per day in each hospital category. In Health Centres and Dispensaries, the estimation of the clinical waste production is based on the daily number of patients.

Results

At Health-Care Facility Level

Since the level of care and services provided in one type of facility cannot be distinguished from those provided in a facility at a lower level, no differentiation was made between Referral, Regional and District Hospitals to estimate the daily production of clinical waste in these establishments. Around 0.41 kg/occupied bed/day of clinical waste were generated in these Tanzanian Health Institutions. In Health-Care Centres and Dispensaries, around 0.03 kg/patient/day of clinical waste were generated.

At National Level

The overall production of clinical waste was estimated between 12 and 14 tons per day for the entire country.
As the table shows, some 50% of the HCW was generated in the 7 regions that produce each over 5% of the total production of HCW. These regions (Dar-Es-Salaam, Kagera, Iringa, Kilimanjaro, Arusha, Pwani and Mwanza) were therefore considered as priority areas for the application of the HCWM plan.

REGION	CLINICAL WASTE PRODUCTION (kg /bed/day)			% total production	% Cumulative
	Hospitals	Health Centres	Total		
RUKWA	164,4	60,4	224,8	2%	2%
MORONGORO	326,36	45,6	371,96	3%	4%
KIGOMA	315,7	70,8	386,5	3%	7%
MARA	375,6	70,2	445,8	3%	10%
LINDI	419	42	461	3%	13%
SINGIDA	476,4	45,2	521,6	4%	17%
MTWARA	453,1	72,8	525,9	4%	21%
SHINYANGA	446,9	86,2	533,1	4%	25%
TABORA	512,5	74,6	587,1	4%	29%
TANGA	617,5	114,0	731,5	5%	34%
RUVUMA	672,8	76,0	748,8	5%	40%
MBEYA	665,8	87,0	752,8	5%	45%
DODOMA	696,2	66,8	763,0	5%	50%
DAR ES SALAAM	698,2	123,6	821,8	6%	56%
KAGERA	710,1	126,0	836,1	6%	62%
IRINGA	737,6	158,6	896,2	6%	69%
KILIMANJARO	823,3	92,0	915,3	7%	75%
ARUSHA	934,4	72,6	1007,0	7%	82%
PWANI REGION	1118,9	38,4	1157,3	8%	91%
MWANZA	1045,5	272,6	1318,1	9%	100%
TOTAL	12210,2	1795,4	14005,6		

Figure 5: estimation of the quantities of HCW generated, the example of Tanzania

2.4 *Characterise the HCWM practices*

All HCWM plans should contribute in reducing the occupational risks linked to the handling and the treatment of HCW. In order to develop a realistic and step-by-step National HCWM Plan, it is essential to be able to characterise correctly the HCWM practices. This characterisation enables to inventory the adequate and non-adequate practices and hierarchies the priorities that should be stipulated in the Plan.

2.4.1 *Checklist of actions*

- ❑ Describe the different types of waste streams found in the country;
- ❑ Assess per hospital category the on-site HCWM practices along the HCW stream from segregation, packaging, handling, on-site storage and transportation, off-site transportation, treatment to final disposal;
- ❑ Analyse the public health and environmental risks associated with the practices encountered in the HCFs;
- ❑ Give an indication of the kind of training on HCWM that (non)medical staff gets in the health-care facilities. Assess what training / educational materials are available at all levels and if they are used / distributed properly;
- ❑ Make an inventory of the existing treatment / disposal facilities and their operational status.

2.4.2 *Recommendations*

- Always carry out separate interviews with the medical staff and the hospital administrations;
- Try to list the actions that will have to be prioritized in the HCWM plan.

2.5 Analyse the institutional and monitoring capacities

Well-defined responsibilities and duties are essential to operate an *integrated* HCWM system. The responsibility of the different components of the HCWM system is shared between the:

- *Director and administrator* who are directly in charge of the overall implementation of a safe HCWM system inside the hospital;
- *Infection control nurses* who have an important role in training both medical and non-medical hospital staff;
- *Store keeper* in charge of the supplies of consumables;
- *Nurses* in charge of the segregation under the supervision of the *head nurse* and the *matron* of the hospital;
- *Sanitary labourers* in charge of the packaging, waste collection and on-site disposal under the direct supervision of the nurses;
- *Municipal actors* in charge of several health facilities and solid waste management services;
- *NGOs and CBOs staff involved* in waste management and recycling.

2.5.1 Checklist of actions

- ❑ Analyse the institutions/offices responsible for HCW management, hospital hygiene and infection control, budget allocations and sanitary inspection;
- ❑ Analyse their operational and financial capacities and their respective roles;
- ❑ give an indication on how the costs are recovered within the health system and analyse the financial resources and the planning;
- ❑ Check how the monitoring (if any) of HCWM practises is ensured;
- ❑ Evaluate the awareness of staff and the training needs.

2.5.2 Recommendations

- During the data collection and analysis, try and identify which institutions/individuals seem to be in the best position to participate actively in the monitoring process which will have to be set-up within the HCWM Plan;
- When analysing how the costs are recovered within the health system, try to see which already operational mechanism/institution could be used to cope with the financing of the HCWM process to be implemented;
- To evaluate the awareness / training needs of HCF staff, apply a standard set of questions adapted to each category of staff using a rating system. This should help identify as precisely as possible on which aspects training curricula should emphasize on;
- Generally, while collecting data on the field, take note of any constructive comments/ suggestions that could help to produce an effective and realistic HCWM Plan. It is also a unique opportunity to foster a participative approach from the main actors in the management of HCW and gaining their support to the project.

3 Guidance to develop a National HCWM Plan

This section presents a list of recommended actions that should be set-up by the central Government to improve the HCWM practices and set-up safe HCWM procedures in the HCFs of the country. The development of the plan should particularly aim at establishing standardised, routine and homogenised management procedures in all the HCFs of the country; identifying hazardous HCW streams inside and outside the health-care facilities; implementing a tracking system that enable to monitor and control the hazardous HCW production and management in the health-care facilities; reducing occupational risk and control nosocomial infections as well as protect the environment; and finally, enabling to treat the waste at a reasonable cost and reducing environmental pollution.

The central Government should develop a HCWM plan through six specific objectives that should be set-up simultaneously. To achieve these objectives six packages of actions, defined according to their objectives, are required. They are presented hereafter:

- Objective 1: develop the legal and regulatory frameworks for HCWM;
- Objective 2: rationalize the HCWM practices within the HCFs of the country;
- Objective 3: develop specific financial resources dedicated to HCWM;
- Objective 4: launch capacity-building and training measures;
- Objective 5: set-up a monitoring plan;
- Objective 6: reduce the pollution associated with HCWM

3.1 Develop the legal and regulatory framework

The establishment of laws and regulations on all the aspects of HCWM is the backbone to regulate and enforce proper HCWM practices in any country. The National Constitution should be completed by a *policy document* and *national guidelines*.

The *policy document* on HCWM should outline the rationale for legislation as well as the goals and the essential key steps to achieve these goals. The *national guidelines* associated with the legislation should be practical and directly applicable. They should include the minimum obligatory procedures for the safe management of HCW.

The establishment of a precise, strong and comprehensive legislation related to the management of HCW is a crucial point. Central, regional and municipal governments should edit a specific Law that would aim at providing the acceptable framework in which HCW should be managed, treated and disposed of. It is actually essential that the Government edit a Law that provides the minimal administrative and management requirements that should be respected within the country.

Considering the difficulties that certain countries are confronted with regarding the enforcement of legislation, the public health and environmental goals that should be achieved can be met to a great extent through training and awareness campaigns (TV, radio, songs, education programmes in schools…) which show the risks each and everyone is exposed to when HCW is mismanaged and the ways to minimize them.

3.1.1. *Check list of actions*

- ❑ Set-up a National Policy and National Guidelines on HCWM;
- ❑ Formulate a National Strategy for HCWM;
- ❑ Elaborate a National Law on HCWM in order to harmonize the state/regional laws and to enforce the HCFs in setting-up HCWM plans;
- ❑ Reinforce internal rules in the medical institutions to comply with the HCWM plans;
- ❑ Develop a protocol for the monitoring/auditing of the HCWM plans established in the HCFs;
- ❑ Elaborate instructions and obligations that should be contained in contract arrangements between the medical institutions and the private contractors;
- ❑ Organise inspection visits.

3.1.2. Recommendations

The National Strategy should:

- Reflect priorities within HCFs for treatment and disposal of HCW;
- Set goals for and means of monitoring infection control and environmental protection;
- Offer a choice of technologies for packaging, transportation, treatment and disposal;
- Prioritize centralized or decentralized treatment and disposal options;
- Reflect distribution of responsibility in the sector between central, regional and local Authorities;
- Propose an action and investment plan for the implementation of improved HCWM;
- Propose guidelines for HCWM training programmes at HCF, municipal, regional and country levels.

Box 2 provides basic information on the provisions that a Law on HCWM should contain. The Legal and regulatory documents should address in priority the following points:

- Administrative responsibilities and penalties for HCWM should be clearly defined based on the polluter pays principle[7];
- Directives for the sanitary inspectors should be set-up;
- The central and regional Authorities should ensure that the HCWM plan of each hospital is in conformity with the National Guidelines. They should set up regular monitoring and control procedures;
- Great care should be paid in the National Guidelines regarding the safety of injections, and blood transfusions (sharps and catheter handling and disposal);
- Procedures and documents for controlling the flow(s) of HCW and increasing the responsibility of the staff should be established;
- National directives defining the procedures of segregation, packaging, collection, transport, treatment and final disposal should be established.

3.2 Rationalise the HCWM practices in the HCFs

The central Authorities should encourage the elaboration and the implementation of such plans in all the HCFs of the country so as to rationalise the HCWM practices and reduce the health and environmental risks associated with improper practices[8].

The backstopping of the District and Regional Health Authorities in the establishment of these plans is crucial since the HCFs have to adopt a planning strategy not only according to their institutional capacity but also according to their immediate environment.

3.2.1 Check list of actions

- ❑ Define acceptable procedures of HCWM and requirements for HCW disposal technologies;
- ❑ Set-up a Guidance note for the establishment of HCWM plans in HCFs;
- ❑ Establish HCWM plans in the medical institutions;
- ❑ Elaborate a catalogue of the equipment needed for the safe management of HCW;
- ❑ Write tender and bidding documents to get offers;
- ❑ Stimulate the private sector to produce cardboard safety boxes for sharps (for example);

[7] The polluter pays principal implies that all producers of waste are legally and financially responsible for the safe and environmentally sound disposal of the waste they produce.

[8] Annexes 3 and 4 provide detailed instructions related to the establishment of HCWM plans in medical laboratories and within HCFs.

- Supply the medical institutions with segregation, packaging and collection as well as transportation material for HCWM (including protective clothes);
- Encourage district/regional HCWM plans;
- Equip some referral Hospitals with appropriately sized HCW disposal and treatment facilities (see annexe 2) where district/regional HCWM plans exist.

3.2.2 Recommendations

A HCWM Officer should be nominated in each HCF. His position should be officially recognised and be held by senior officers capable to co-ordinate and influence the team of the hospitals (DoH, infection control nurses, matrons, and administration). Where treatment or disposal facilities exist, a technical team should be nominated for the maintenance of the treatment/disposal systems. The composition and the size of the team will depend on the type of disposal facilities and the option for waste management that are selected.

The private sector should be encouraged to involve itself and comply with the technical requirements issued by the National Authorities for HCWM handling and disposal. Subventions could be foreseen for the private enterprises ready to commit themselves in producing disposal material/equipment at a reasonable price (e.g. WHO/UNICEF sharp boxes).

3.3 Develop specific financial resources dedicated to HCWM

Without specific financial resources, it is impossible to get sustainable improvements in the management of health-care waste. HCWM is an integral part of health-care and thus needs to be budgeted for.

The calculation of the financial resources necessary to manage the HCW will have to be done both at HCF level but also at regional and national level, especially when centralized HCW treatment/ disposal systems are envisaged.

A specific recovery mechanism will have to be chosen and set up and the institution in charge of the implementation identified. The standard option is that of a tax on the medical items which is determined according to treatment/disposal costs related to each item. The institution controlling the process is often a Central pharmacy of medical supply purchasing unit/department.

To ensure that the amounts allocated to the management of HCW aren't used for other purposes, specific budget lines should be developed at all levels of the accountancy (HCF, local / district, regional and national) and controls performed on a regular basis.

3.3.1 Check list of actions

- Set-up of specific budget lines in the accountancies at all levels from HCFs to the MoH;
- Detail estimation of the costs associated with the implementation of the HCWM plans in the HCFs as well as at municipal, district, regional and central level;
- Define and set up a specific mechanism to recover the costs in a centralized system. If a tax option is chosen, determine the tax rate for each medical item;
- Identify the institution to be in charge of the implementation of the recovery system and provide it with all the necessary tools to perform its work.

3.3.2 Recommendations

- A cross-check mechanism should be set up so as to be able to have an efficient control system of the way the amounts destined to the management of HCW are used;
- Assign oversight responsibilities to appropriate staff in the MoH as well as at the health-care facility level.

The points hereafter provide some key information that should always be formulated in a Law on health-care waste management. Such a Law would complete the Blueprints edited by the Ministry of Environment on the management of hazardous chemicals, hazardous and solid waste management.

1. General provisions of the Law
   1 Explain the *object* of the Law: the main object is to regulate the generation, handling, segregation, collection, transportation, treatment and final disposal of all the health-care waste generated by veterinary and health activities of preventive, curative, palliative treatments, activities of research as well as industrial production in relation with biomedical products.
   2 Explain the *objectives* of the Law: the objectives of the Law are that every producer and operator of health-care waste comply with the management, treatment and disposal procedures stipulated in the Law and abide by the registration and tracking provisions contained in the Law.
   3 Provide definitions and a classification of "health-care waste": the definitions provided in the Guidance Manual and inventory could serve as a basis regarding this point.
   4 Provide definitions on "generation, handling, segregation, collection, transportation, treatment and final disposal".
   5 Give a definition of the "health-care waste producers" and the "health-care waste operators".

2. Authorities of enforcement
   1 Explain which institution is responsible for the enforcement and the coordination of the policy on health-care waste management.
   2 Explain what should be the different competencies of the, District and Regional Authorities of Health and Environment regarding health-care waste management.
   3 Describe the enforcement power of each of the authorities listed above.

3. Provisions related to health-care waste producers and operators
   1 List the type of institution that should be considered as a producer in the framework of the Law. Are considered as a producer of health-care waste all the physical or legal bodies, public or private, whose daily activities generate health-care waste in the sense of the definition given by the Law.
   2 List the type of institutions / societies that should be considered as operators.
   3 List the obligations that each health-care waste producer and operator should comply with to be allowed to operate: registration procedures to enforcement authorities, list of environmental mitigation measures taken…
   4 Inventory the compulsory measures that should be taken by the health-care waste producers and health-care waste operators to reduce health risks for the staff. Should be listed in the Law: training courses on the risks and the precaution measures that should be taken during the handling, transportation and treatment of health-care waste; medical check-up to be carried out in case of an accident; compulsory immunisation vaccines that staff being in contact with health-care waste should receive; equipment that the staff dealing with health-care waste should receive; the security instructions and guidance manual that should be available for the staff in any establishment generating health-care waste; Inventory the compulsory measures that should be taken by the health-care waste producers to reduce the environmental impact of health-care waste management.

4. Provisions related to management, treatment and disposal procedures
   1 List all the management procedures that the producers should comply with: segregation, handling, on-site transportation, storage, off-site transportation, on/off-site treatment and final disposal.
   2 Describe the standard treatment and disposal norms that should be respected by health-care waste producers and operators to get an operating certificate issued by the Ministries to allow them to run their activities.
   3 Give the duration of validity of the certificate.
   4 Provide specific provisions in case of an accident.
   5 Describe and inventory compulsory labelling and tracking measures.
   6 Provide standardised labelling and registration forms in the annex of the Law.

5. Penalties
   1 List the major mismanagements that would lead the enforcement authority to withdraw the certificate and to apply penalties.
   2 Define the penalties to be applied in the framework of the Law.

Box 2: minimum requirements for the establishment of a Law on HCWM

3.4 Launch capacity-building and training measures

The Central, regional or district Health Authorities should ensure that all the hospitals prepare and implement a proper HCWM plan. They should support them in the definition and the implementation of the HCWM plan by providing technical advice, supplying adequate material and allocating sufficient financial and human resources. In particular, they should set up periodic training programmes on HCWM for the staff involved in HCWM, review programmes in all the Faculties of Medicine and the Nursing Schools to ensure that adequate training on HCWM is given. The following target groups should receive training:

- Regulators and decision makers;
- Central, regional, district, and municipal authorities;
- HCF administrators;
- HCF medical and non medical staff;
- Private operators if they are involved.

3.4.1 Check list of actions

- ❑ Set-up mechanisms to backstop the HCFs;
- ❑ Set-up a national awareness campaign for the target groups;
- ❑ Constitute groups of trainers and elaborate of a training programme for them;
- ❑ Train the trainers in a participative and practical way;
- ❑ Organise regular welcome training sessions in the HCFs for all new staff members;
- ❑ Review the curricula in the medical faculties & schools for nurses.

3.4.2 Target groups

In addition to the target groups mentioned, the following groups should receive training or sensitised regarding the importance of sound management of healthcare waste. Training /awareness raising programmes could be designed to suit the different groups identified.

- Non-Governmental Organizations - this group can serve as “whistle blowers” and assist in training and awareness raising when capacitated.
- Community Based Organizations- This group can serve as “whistle blowers” when capacitated
- Traditional healers
- Homecare givers
- Students from relevant professional groups
- Veterinary services personnel
- Pharmacists

3.4.3 Recommendations

The awareness programmes should only be launched when appropriate means (budgetary and technical) for the different steps along the HCW stream are available.

3.5 Set-up a Monitoring Plan

The set-up of a monitoring plan as well as adequate control procedures at national, regional and health facility levels is a key issue to ensure sustainability. Regular reporting and field visits as well as a good information system to store and analyse the data are the basis of an efficient monitoring plan.

The monitoring plan should aim at providing relevant information for two different but complementary objectives:

- Progress in the implementation of the HCWM plans within the HCFs and evaluation of the impact of the National HCWM Plan;
- Measure the Operation and Maintenance[9] (O&M) performance of the health services to maintain a good standard of HCWM within the HCFs.

The Monitoring Plan must provide the necessary *tools* to measure if these objectives have been reached. They include:

- The set-up of adequate indicators of achievement or performance. *Qualitative* should always be coupled with *quantitative* indicators in order to monitor and evaluate the outcome of the HCWM plan.
- A *simple, regular reporting system* to keep the appropriate authorities constantly informed with sufficiently accurate and relevant information that can be easily verified, enabling decision-makers to change the implementation strategy if necessary based on the practices encountered in the HCFs;
- The set-up of regular control and backstopping activities carried out by the Central and Regional Health Authorities, addressed to the HCFs.

3.5.1 Check list of actions

- ❑ Standardize recording and management procedures for all level (primary, secondary, tertiary health facilities, district, regional and national administrations);
- ❑ Set-up a reliable information system;
- ❑ Establish adequate control and backstopping procedures.

3.5.2 Recommendations

The establishment of a HCWM plan should progressively lead the medical institutions and the administrative authorities to consider HCWM as a routine issue to cope with and reinforce progressively their organisational capacities. The MOH should oblige the major hospitals to formally nominate a Health-Care Waste Management Officer (HCWMO) and an Infection Control Committee (ICC). The HCWMO, in coordination with the ICC should co-ordinate and supervise the whole HCWM system. He/she should have sufficient authority to ensure that all hospital staff complies with the HCWM plans. In each medical institution, roles, responsibilities and duties of the medical and non-medical staff regarding HCWM should be well defined in standardised personal job descriptions.

The consolidation of the on-going management and administration procedures includes (see figure 7):

- Annual reporting of the HCFs to the supervising administrative authorities, with the set-up of annual HCWM plans;
- The gathering and the review of the reports by districts and regional authorities and the adequate review of the HCWM Plans at their level, based on the information provided by the HCFs. These plans should contain at least: 1) an inventory on existing treatment and disposal facilities in each HCF; 2) a compilation of the needs for each HCF and recommendations; 3) an estimation of the budget to be allocated for the management of HCWM in the coming year; 4) a strategy to improve the management of HCW in the region; 5) a provisional agenda for the monitoring of the disposal facilities located in the HCFs;
- The integration of the above data in the national health information system to have a better knowledge of the status of the HCWM practices in the medical institutions and regions. They will be able to modify the *National HCWM Policy and Strategy* if required;

[9] *Operation* refers to the procedures and activities involved in the actual delivery of services while *maintenance* refers to activities aimed at keeping existing capital assets in serviceable conditions.

- Carrying out regular inspections to verify at least that segregation procedures are respected and safety measures applied;
- The backstopping of the different HCFs by providing a feedback on the problems observed and giving appropriate training and advice to correct/improve the current practices.

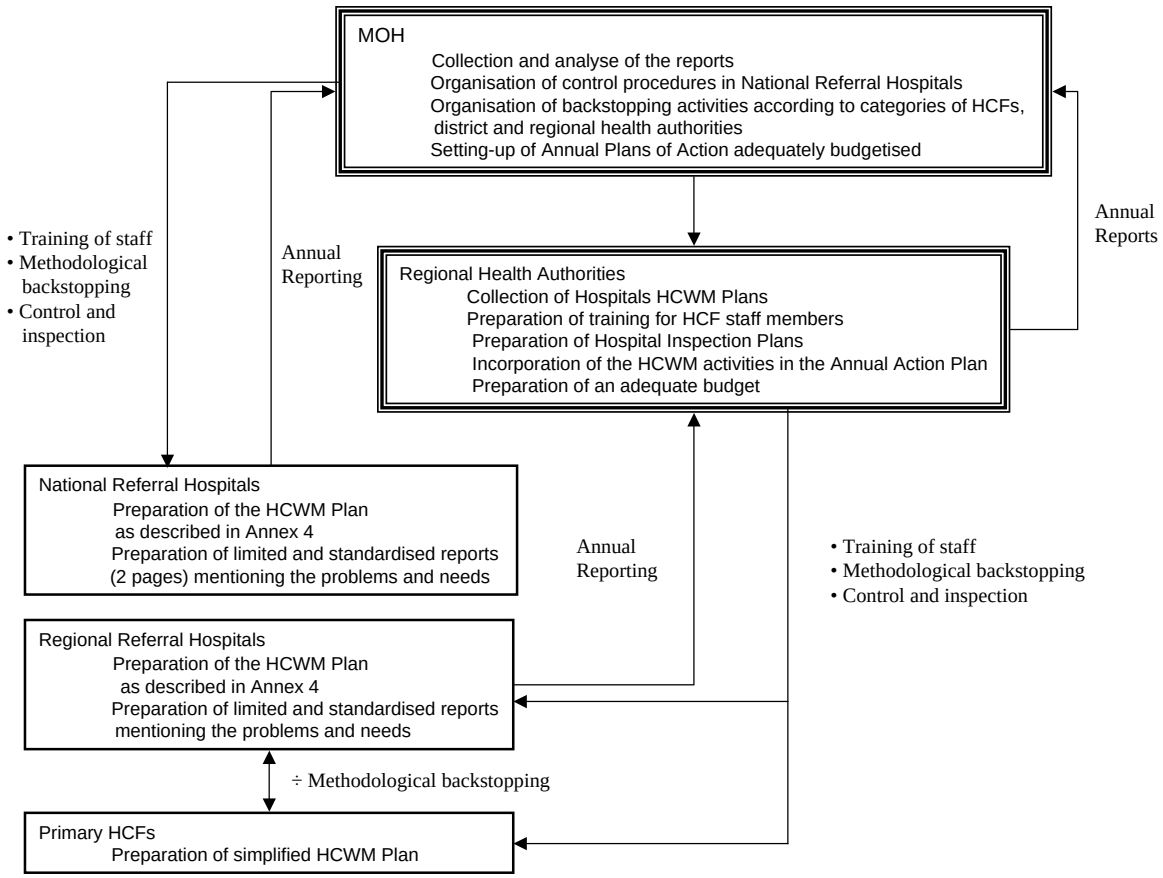


Figure 6: National Monitoring Plan for HCWM

3.6 Reduce the pollution associated with the management of HCW

Best techniques and practices in HCWM to reduce pollution should be demonstrated in selected HCFs. This will include developing model hospitals and/or model rural health clinics. Pilot projects can demonstrate best practices for HCWM that can avoid/reduce drastically unnecessary pollution. The various experiences gained can then serve as a framework to review national medical waste policies and regulations. This should be seen as an ongoing process which aims at improving constantly HCWM practices so that they may take into account both the new types of waste as well as the innovative treatment/disposal technologies that can be found.

3.6.1 Check list of actions

- ❑ Review existing HCWM practices and policies, including purchase and product utilization policies;
- ❑ Establish waste minimization and waste management objectives for each category of HCF;
- ❑ Propose and adopt modifications in current practices and policies aimed at achieving objectives;

- Establish management structures and management techniques that will ensure that new policies and practices will be properly carried out;
- Train both managers and staff to carry out the new policies and practices;
- Select and deploy appropriate waste treatment approaches;
- Monitor and review progress: provide ongoing support and assistance to ensure objectives are being met. Revise approaches as needed;
- Establish a countrywide or regional training program, with access to the facility, to train and certify experts who can then implement similar best practices at other health facilities in the country and/or region.

3.6.2 Recommendations

Best practices in reducing HCW to avoid environmental releases of dioxins and mercury should be demonstrated in several HCFs of the country in the framework of a pilot project. Increased awareness about persistent organic pollutants (POPs) and other toxic substances within the medical and health care sector should be promoted.

4 Guidance to develop a strategy to implement the National HCWM Plan

Once the *National HCWM plan* is drafted, it is necessary to amend and validate it. Actually, this document should also be amended and validated with the *National Guidelines* and the *National Policy* so that the Government may have a comprehensive and coherent package to tackle HCWM issues.

The *National Guidelines* should be practical and directly applicable with the aim at helping the different HCFs of the country set-up adequate HCWM procedures as required in the legislation[10].

The *National Policy* should outline the national goals and the key steps essential to the achievement of these goals.

The Government must develop a *step-by-step strategy* to improve the HCWM in the HCFs of the country and reduce significantly the occupational risks associated with the current practices. The strategy should show clearly the medium and the long-term objectives to be achieved and reflect the integrated effort that is necessary to set-up safe and environmentally sound HCWM practices. Whenever possible, it should underline the institutional and individual responsibilities as well as define the monitoring and administrative procedures.

It is of the utmost importance that the national, regional and municipal authorities implement new HCWM procedures in close co-operation and induce the Hospital Authorities to develop their own HCWM plan. *New standards (segregation procedures first) should be applied first in the Hospitals of the tertiary level that could serve as referral medical institutions for the state and local medical establishments.* A four-step approach is proposed:

- Step 1: organise a National Workshop;
- Step 2: set up the institutional framework to initiate the HCWM plan;
- Step 3: establish a National Action Plan to implement the HCWM Plan.
- Step 4: layout a time frame for the implementation of the National Action Plan.

4.1 Step 1: organise a National Workshop

The organisation of an initial *National Workshop* should include representatives of the Ministries of Health, Environment and Finance; representatives of State and Local Governments such as national associations of local authorities, representatives of the Academy of Medicine and Nursing Schools as well as associations involved in the health sector. During the workshop, participative decisions should be taken to ensure a good co-operation between all the stakeholders for the future implementation of the plan. The following Ministries/Departments could also be included, however this will differ from country to country. This composition should also reflect at the Steering Committee level:

- Ministry/Department of Labour
- Department of Public Works
- Department of Provincial and Local Government
- Department of Water Affairs (responsible for landfill sites permits)

Other representatives could be from non-governmental organizations, community based organizations, representatives of those involved in the healthcare waste management industry

The implementation of the HCWM plan will require a regular commitment and monitoring. It is highly recommended that the *National Steering Committee for HCWM* (NSCHCWM) already mentioned under section 3.1 be in charge of this supervision and coordination task (see flow-chart below). During the workshop, the Committee should be reinforced and it's new members designated. In addition, specific *working groups* (see step 2) should also be established once all the participants are in

[10] For instance: hygiene in hospitals and occupational health and safety, responsibilities and duties of staff, separation, handling, storage and transport procedures, recommended treatment and disposal methods for each category of HCW, etc…

agreement with the *National HCWM plan,* the *National Guidelines* and the *National Policy*. It is during the workshop that these three documents should be amended and validated.

4.2 Step 2: set-up the institutional framework to initiate the HCWM plan

The *National Steering Committee for HCWM* should supervise the overall implementation of the HCWM plan. The members should meet on a regular basis (a minimum every three months). A large number of institutions should be involved in this Committee in order to obtain a broad consensus for the implementation of the HCWM plan. The involvement of Bilateral or Multilateral Agencies should also be sought to obtain, *inter alia*, a potential financial support for the implementation of the Plan.

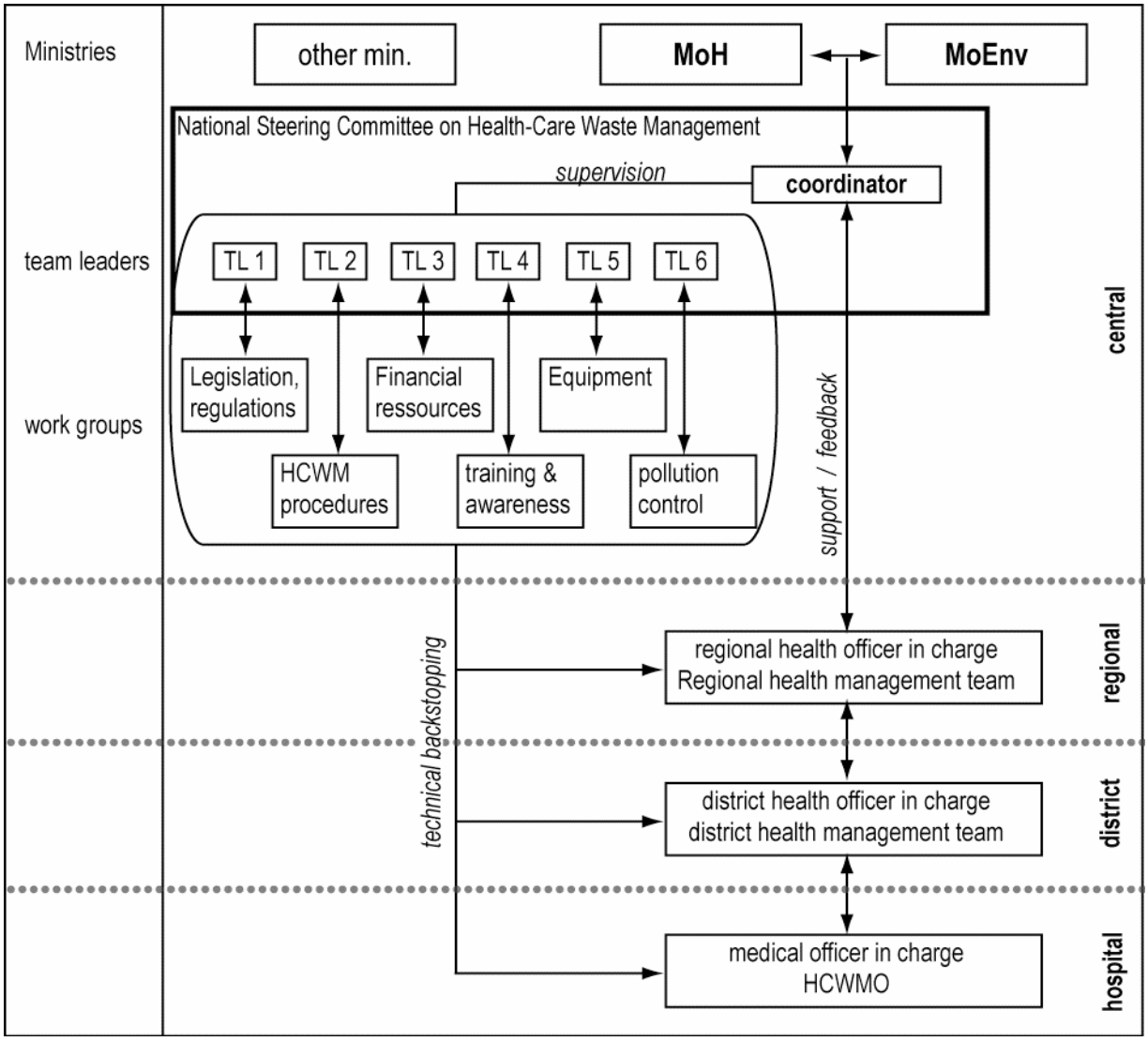


Figure 7: Suggested institutional framework for the implementation of the HCWM Plan

The tasks of the *National Steering Committee* should be the following:

- Nominate a project co-ordinator;
- Compose the working groups;
- Establish the criteria for the evaluation of the HCWM plan during its implementation;
- Designate the administrative authorities in charge of the implementation of the HCWM plan at State and local levels;
- Select institutions and Provinces to test the HCWM plan already established;
- Set-up *intermediary* and *final* evaluations of the implementation of the HCWM plan.

The *project co-ordinator* should be assigned a full time post during the overall duration of the implementation of the plan (i.e. five years minimum). He/she should have excellent organising, managing and communication skills and should receive external support if necessary. He/she should co-ordinate the work of specific task groups that will be established by the Steering Committee.

4.3 Step 3: establish a National Action Plan to implement the HCWM Plan

The implementation of the six objectives contained in the National HCWM Plan will require the development of specific actions. These actions, should be included in a *National Action Plan* (NAP) that will be periodically monitored and reviewed. As mentioned previously, a typical time frame for a NAP is around five-years. For each action, it is necessary to set-up indicators of achievement that will help the regular monitoring of the Plan. The figure below provides an example of how the objectives of such a plan (in this case, objective 1) could be laid out.

1. Develop the Legal and Regulatory Framework

	Actions			Co-ordination	Supervision	Indicators of achievement	Cost	
							Initial	Annual
	Short-term							
	Long-term							

Recommendations

- *National Guidelines* should be urgently written and distributed to the HCFs by the MOH. Ideally, a *Catalogue of the Equipments* available in the country for the safe management of HCW (see table on the standardisation of the HCWM procedures) should be annexed to these guidelines as well as the HCWM registration forms and certificate…
- The regulatory documents should clearly define roles, responsibilities, duties and penalties in relation with the (mis)management of HCW (cf. part … of this report).
- The criteria for enforcement and inciting measures to ensure that the medical staff complies with the management procedures defined in the Law and described in the "National Guidelines" as well as the review of the Health Worker job description and their Code of Ethic should be set up together with the representatives of the Medical Doctor and Nurse Associations.
- The government will need to get external support to prepare the National Guidelines, establish the Code of Hygiene and prepare a Law on Hazardous Waste.

Figure 8: Example of the one of the objectives of a National Action Plan (NAP)

The following general scheme of actions should be taken as a minimal basis:

1. List the initial measures to be taken in all HCFs to upgrade the internal handling of the most hazardous HCW (segregation of sharps);
2. Implement pilot projects in selected national hospitals and introduce monitoring procedures for infection control, HCWM inside the hospitals and environmental impact;
3. Assess the lessons learned for the pilot projects and review the National Documents if necessary;
4. Implement gradually the national HCWM plan, first in national hospitals;
5. Develop simultaneously local and central infrastructures for HCW disposal;
6. Evaluate the results in an intermediate progress report before implementing the NAP in the whole country as described hereafter;
7. Develop a framework programme for capacity building and training addressing new developments and different target groups;
8. Generalise the HCWM plan at national level.

The supervising and the co-ordinating institutions, with their respective duties should be clearly identified at all levels for the implementation of the specific actions. Minimum requirements are:

- At *National* level, a task force is responsible for the overall implementation of the HCWM plan. It includes the National Steering Committee in charge of the overall supervision of the HCWM plan, the project co-ordinator and the working groups;
- At *Regional* level, the Secretary of Health is responsible for the good supervision of the HCWM within the region. The Medical Officer of Health is in charge of the implementation in the Health Units;
- Finally, at *hospital* level, each Director is administratively responsible for the HCWM within his/her institution. He/she watches over the application of the rules and nominates the team(s) in charge of the management of the HCW.

4.4 Step 4: layout a time frame for the implementation of the NAP

The timeframe presents the breakdown of the activities over the whole duration of the HCWM Plan. It enables to underline the *coordinated approach* that will have to be adopted between all the different objectives.

In the example below, the first column lists the number of each action (typically 1.1 or 101 for the first action of the first objective; 2.20 or 220 for the twentieth action of the second objective, etc.). The second column provides part of the action labelling for easy reference. The remaining part of the table provides information as to when each action is supposed to be implemented with regards to the others.

ID	Actions	2001				2002				2003				2004				2005			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
220	Elaborate directives for inspectors																				
222	Elaborate control mechanisms																				
224	Organise regular visits																				
300	Implement new budget line																				
310	Estimate HCWM costs																				
311	Calculate the rates for the taxing system																				
313	Equip central and HCF pharmacies																				
314	Establish new accounting system																				
401	Assess medical staff training curricula																				
404	Set up a radio programme in local language																				
410	Involve the University in research programme																				
411	Create communication material for HCFs																				
500	Assess training needs based on field observat.																				
501	Create a core group of trainers + train them																				
510	Organise training sessions at district level																				
512	Training of auxiliary staff at HCF level																				
600	Intermediary evaluations																				
601	Final evaluation & report																				

Figure 9: Example of how a time frame for the implementation of a NAP could be laid out

Conclusion

Health-care services in rural or urban settings inevitably generate wastes that may be hazardous to health or have harmful environmental effects. Some of them, such as sharps, cultures from medical laboratories or infected blood, carry a higher potential for infection and injury than any other type of wastes. The absence of or improper management measures to prevent exposure to hazardous health-care waste (HCW) results in important health risks to the general public, in- and out-patients as well as the medical and ancillary staff. Furthermore, improper treatment or disposal of HCW, such as open-air burning, can constitute a significant source of pollution to the environment through the release of substances such as dioxins, furans or mercury.

Safe management of HCW is a key issue to control and reduce nosocomial infections inside a hospital and to ensure that the environment outside is well protected. The current practices encountered in most of the Sub-Saharan countries of Africa do not comply with the international requirements to guaranty a safe and environmentally sound management of HCW: the full spectrum of health-care waste management (HCWM) practices are found in the health-care facilities (HCFs), from the most hazardous ones where no segregation system is applied and the waste is simply dumped in the backyard to safer procedures where the waste is segregated and the part considered as hazardous is incinerated separately. To significantly improve the current situation, the Governments of most of the Sub-Saharan countries of Africa must develop a medium and long-term *national strategy* that should become an integral feature of the HCFs. This strategy should reflect the integrated effort that is necessary to set-up safe and environmentally sound HCWM practices. In particular, a special attention should be paid to the following points:

- At each administrative level, *clear institutional and individual responsibilities should be established*. Moreover, specific monitoring and administrative procedures should be set-up and adequate resources allocated to ensure a proper management of the HCW;
- *Adequate awareness and training programmes* for health officers and planners, hospital administrators, medical staff and environmental health officers should be developed;
- *Appropriate, environmental-friendly and affordable* technologies should be selected for the treatment and the disposal of HCW, taking into consideration both technical and financial resources available in the country.

In many Sub-Saharan countries, the lack of resources in the health sector tends to affect negatively the way HCW is managed. Furthermore, for a given country, the situation can differ significantly from one region to the other depending on the resources (financial, human and material) locally available. Under these adverse circumstances, planning remains a key issue. It requires the definition of a strategy that takes into account the given constraints and opportunities, appropriate allocation of resources, clear formulation of objectives, practical indicators of achievement and a well-structured timeframe.

Preparing and implementing a HCWM plan requires developing sequential steps that are presented in figure 10. The satisfactory execution of each of these steps is strongly dependent on the completion of the other ones; none can be omitted but they can be tackled in varying sequences. Special attention must always be paid to the *analysis of the situation* and the *formulation of adequate recommendations* as well as to the *elaboration of the implementation strategy*.

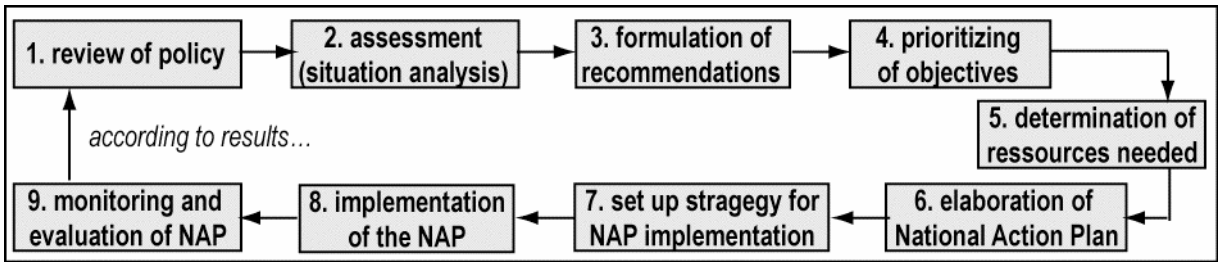


Figure 10: The Planning Progression

Annexe 1
Fundamentals regarding the management of syringes and needles

Sharps represent one of the most problematic and hazardous types of waste generated within HCFs. Syringes and needles are of particular concern because they constitute an important part of the sharps and are very often contaminated with blood. The occupational risks are linked to:

- The great quantities that are manipulated daily by health-workers and generated throughout the world for both curative and preventive activities;
- The cuts and punctures they may cause followed by a potential infection of the wounds. The main diseases of concern are those which may be transmitted by subcutaneous introduction of the pathogens such as viral blood infections;
- The scavenging and re-use practices that occur in some countries, exposing the populations (and most particularly children) to risks of cross contamination.

All biomedical and health-care waste with sharps or pointed parts have a high potential to injure and inoculate potentially dangerous pathogens. *They must therefore be categorized as infectious waste* and have to be manipulated, discarded, transported and disposed of with maximum precautions by health workers.

Due to the lack of reporting at HCF level, needle-stick injuries occurring worldwide are globally underestimated. However a recent study carried out by the WHO shows that, depending on the country, a nurse can get a needle-stick injury more than twice a year. Therefore, handling and disposing of safely needles and syringes, and more generally sharps, must be seen as an absolute priority by the Health Services of any country. The safe management of sharps requires that one:

- Define a strict policy at national level with clear handling and disposal protocols to be respected in all HCFs;
- Provide each HCF with adequate equipment for sharps discarding and disposal;
- Ensure that all HCF staff are aware of the protocols and are properly trained (in-service training and review of the initial curricula are often necessary);
- Establish a system to report accidents that occur and monitor the application of the policy.

It is internationally recognized that the safe management procedures of sharps should comprise the following practices:

- A health-worker performing an injection or the staff member transporting health-care waste should always wear appropriate gloves (a study carried out at the Geneva University Hospital – Switzerland – showed actually that more than 50 % of the blood remaining in an infected needle is stopped by the gloves when a needle-stick injury occurs);
- All disposable syringes and needles should be discarded immediately following use. The needle should never be recapped since most of the accidents occur when the nurses attempt to recap the needles;
- Under no circumstances are syringes or needles (or the full containers) to be disposed of with normal garbage or dumped randomly without prior treatment;
- Sharps should be placed in specific cardboard, plastic, high-density polyethylene or metallic containers resistant to punctures and leak-proof, designed so that items can be dropped in using one hand, and no item can be removed. The container should be: 1) labelled with the international biohazard symbol; 2) be of a yellow colour (the international colour coding system for infectious waste strongly recommended by the UN Agencies), and 3) marked «Danger ! contaminated sharps, do not open»;
- The containers should never be overfilled but systematically disposed of once they are three-quarters full. They should not be emptied for re-use, except when specifically designed for this option (see “the MSF practice” and needle cutters described hereafter).

There are two ways of disposing of needles and syringes in a safe way. The first solution consists in discarding the whole combination needle plus syringe in a puncture and leak-proof recipient which, once filled will then be treated/disposed of with other infectious waste or emptied in a sharp pit. The second option consists in separating the needle from the syringe on the spot using a specific device.

Option 1: disposing to complete combination

The basic idea is to discard the whole combination “syringe plus needle” into a safety box immediately after use. The box is then treated with other infectious waste. This option is recommended by the WHO and UNICEF and applied in all industrialised countries. This practice enables to reduce the risk of needle-stick injuries for the medical staff but generates important volumes of sharp waste.

If incineration is the option, temperatures greater than 1’400°C to oxidise completely the needles must therefore be used. Modern pyrolytic incinerators or rotary kilns, which are expensive to install and operate, can therefore be used or alternatively, well operated air-excess incinerators or improved double-chamber auto-combustion incinerators, these kind of incinerators being able to burn the syringes and disinfect the needles at temperatures of 800-900°C. However the ash that is produced during the process still contains the needles and must therefore be carefully buried.

The UNICEF & WHO safety box: a cheap option	HDPE boxes: a much more expensive option
	

Option 2: disposing needle and syringe separately

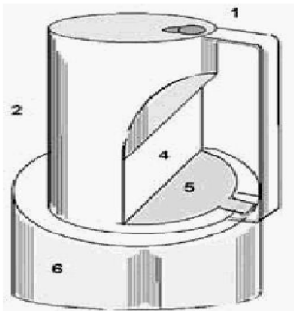
In this option, the needle is separated from the syringe. The main interest of this option is that it enables to reduce drastically (more than 90 percent) the volume of infectious sharps waste that requires special handling. Infectious needles are isolated in a puncture-proof recipient prior to burning, incineration, or burial. The syringe must nevertheless be disposed of in a safe manner (sharp box).

The needle can be separated from the syringe in three ways: removed, cut or destroyed.

a) The MSF needle remover and the PATH “popper”

In this first option one inserts the needle into a slot of a container specially designed to separate it from the syringe using one hand only. The needle drops in the container, which can be made of polyethylene (closed tube or empty drug-boxes, cans, etc…). Once full, the container is safely emptied into a sharp pit, using a system that prevents the user from being in contact with the needles it contains or the container is thrown in the pit with it’s content.

The pit, once full, is encapsulated (i.e. an immobilising material such mortar, clay or bitumen is poured into the pit before it is sealed off) and a new one must be built. This option requires great care from the health-workers when separating the needle from the syringe.

MSF sharp box	PATH needle removal can ("Popper")
	

b) Needle cutters

These devises are installed at the point of use in order to cut the needle from the syringe immediately after use. The needle is inserted into the device, and cut off mechanically by blades. The needle drops into a container, which once full, can either be put in a sharp pit or incinerated. Also already commercialized these types of devices are still being tested. They are relatively inexpensive, robust, easy to use and transport, safe and appropriate in remote areas lacking electricity supply.

A needle remover / cutter

c) Needle destroyers

In these relatively expensive devices, the needle is destroyed at the point of use with the use of an electrical current. The user inserts the needle into a hole or slot in the device, which positions the needle between two electrodes in the device's interior. By contacting both electrodes simultaneously, the needle causes an electric current to run through it which heats the needle to temperatures reaching 1'500°C to 3'000°C. The result is a partial or total oxidation of the needle. Various tests have concluded that these devices are not really suitable in developing countries.

A needle destroyer

The table below

provides a comparison of the advantages and the drawbacks of the different options.

Options	Advantages	Drawbacks
1	• It is possible to dispose of AD syringes • The handling of the needle and syringe is reduced at a maximum enabling to diminish the risks of needle-stick injury • The volume reduction, once incinerated, is drastic (more than 90 %)	• POPs may be produced depending on the incineration system used • If the incineration is not performed at sufficiently high temperatures, the needles remain and ash must be safely buried • Incinerators require regular maintenance to be kept in optimal working conditions
2a	• Once it has been constructed the pit is simple to use and does not require any maintenance • There are no operational costs. The capital costs remain limited • There are no emissions of air pollutants since the needle isn't incinerated • The volume reduction is similar to the one obtained with incineration	• The needle has to be separated from the syringe which may increase the risks of needle-stick injury for the health-workers • It is not possible to dismantle AD syringes, which are used more and more frequently in low-income countries • A new pit has to be periodically built depending on its filling rate • The pit may be filled with other material than sharps and become rapidly full, increasing the construction costs • Requires space within the HCF compound to dig the successive sharp pits
2b	• Idem as 2a • These devices are robust (they can cut between 200'000 and 400'000 needles before the blades need to be changed) • All types of syringes and needle sizes can be dealt with	
2c	• Provides a satisfactory solution to get ride of the needle at the point of use • Avoids the transport of sharps • Does not require an on-going supply of sharp boxes or containers • May be an alternative technology in urban areas for some specialised HCFs where a lot of sharps are manipulated (Mother and child centres, blood banks, STD clinics)	• Requires electricity to run • Require a good maintenance of the device that can "clog " easily if the small amounts of ashes produced are not regularly removed • Expensive solution that will be difficultly to include in a HCWM policy in low-income countries

Annexe 2
HCW treatment and disposal technologies

The choice of a technology for HCW treatment and disposal should always be driven with the objective of minimizing negative impacts on health and the environment. Several technologies exist to treat or dispose of HCW. They include: 1) Incineration in rotary kilns or double chamber incinerators; 2) Burning in single chamber incinerators; 3) Wet thermal treatment (autoclaving); 4) Chemical disinfection; 5) Microwave irradiation; 6) Sanitary landfill, including inertization and encapsulation.

Not all these technologies can be used for the treatment or the disposal of all categories of HCW. The suitable treatment and disposal technologies according to the different categories of HCW are presented in the table below.

4.5 Waste category	*4.6 Rotary kiln*	Two chambers pyrolytic incineration	Single chamber incineration	Wet thermal treatment (autoclave)	Chemical disinfection	Microwave irradiation	Sanitary landfill
A non-risk HCW	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.7 B1 Human anatomical waste	*5 YES*	YES	YES	NO	NO	NO	NO
B2 Waste sharps	YES	YES	YES	YES	YES	YES	YES for small quantities with encapsulation
B3 Pharmaceutical waste Classes B32 and B33	YES	Small amount only	NO	NO	NO	NO	NO
B4 Cytotoxic pharmaceutical waste	YES	NO YES for modern ones	NO	NO	NO	NO	NO YES for small quantities with inertization
C1 Infectious waste	YES	YES	YES	YES	YES	YES	YES
C2 Highly infectious waste	*6 YES*	YES	YES	YES	YES	YES	NO YES only after pre-treatment
D Other hazardous waste	YES	NO	NO	NO	NO	NO	NO YES if specially designed
E Radioactive health-care waste	NO	NO	NO	NO	NO	NO	YES Specially designed

Incineration is not the same as burning. **Incineration** is one of the only technologies that can treat all types of HCW properly and has the advantage of reducing significantly the volume and weight of the waste treated. Incinerators nevertheless require skilled operators, extensive flue gas emission control systems and, frequently, imported spare parts. Incineration generates ash residues and air emissions can contain pollutants such as dioxins and heavy metals.

Burning in small-capacity single chamber "incinerators" is a technique often used in HCFs in low income countries. These installations may nevertheless constitute a serious air pollution hazard to the surrounding area due to the relatively low operation temperatures and the lack of emission control systems. If biomedical and health-care waste are treated with single chamber "incinerators", waste fractions such as cytotoxic drugs, chemicals, halogenated materials or waste with a high content of heavy metals (batteries, broken mercury thermometers, etc.) *should not be treated* with this type of system (see table above).

Incineration /	Advantages	Drawbacks
Pyrolytic or double chamber incinerators (incineration at 800–900°C) Rotary kiln (incineration at 1200°C and higher)	▪ Elimination of health risks due to the complete destruction of the waste ▪ The waste is non-recognizable ▪ Fully destroys micro-organisms and sharps ▪ Reduces significantly volume and weight of the waste ▪ Destroys all types of organic waste (liquids, pharmaceuticals, and other solids) ▪ Important quantities of waste can be treated (except for batch incinerators)	▪ High investment costs ▪ Requires skilled staff to operate ▪ Continuous monitoring required ▪ High maintenance, especially for rotary kilns ▪ Relatively high operation costs; costs rise with the level of sophistication of the emission control systems ▪ For batch incinerators: limited capacity ▪ Emits toxic flue gases (including dioxins and furans) ▪ Generates residues that need safe land-filling
Single chamber "incinerators" (incineration at low temperatures 300-400°C)	▪ Good disinfection efficiency ▪ Reduces significantly volume and weight of the waste ▪ No need for highly trained operators	▪ Significant emission of atmospheric pollutants ▪ Need for periodic removal of slag and soot ▪ Inefficiency in destroying thermally resistant chemicals and drugs ▪ No destruction of sharps

Autoclaving is the exposure of waste to saturated steam under pressure in an enclosed container. Preparation of material for autoclaving requires segregation to remove unsuitable material and shredding to reduce the size of the individual pieces for greater treatment efficiency. Small autoclaves are common for sterilization of medical equipment but HCW autoclaves can be a relatively complex and expensive systems requiring careful design, appropriate segregation of materials, and a high level of operation and maintenance support. The output from an autoclave is non-hazardous material that can normally be land-filled with municipal waste. There is also a wastewater stream that needs to be disposed of with appropriate care and control. Furthermore, large autoclaves may require a boiler with stack emissions that will be subject to control.

Steam Disinfection /	Advantages	Drawbacks
	▪ Relatively simple to operate (a known technology at health-care facilities) ▪ Environmentally sound technology	▪ Relatively expensive to install and operate ▪ Requires boiler with stack emissions controls ▪ Relatively high maintenance costs ▪ Cannot be used to treat some special wastes ▪ Generates contaminated wastewater that needs special treatment

Microwave irradiation is based on the use of a high energy electromagnetic field that heats up rapidly the liquids contained in the waste causing the destruction of the infectious components. The HCW passes through a preparative process which may include segregation to remove undesirable material before it is shredded and then eventually humidified prior to being treated in the irradiation chamber. At the end, the waste goes through a compactor before being disposed of.

Similar to the autoclaving technique, the output from a microwave facility is considered non-hazardous and can be land-filled together with municipal waste. Since the technology does not involve the application of steam, there is a minimal generation of wastewater which can be recycled to the system. Since electricity is the main source of energy for operating this technology, gas emissions are also minimal compared to incineration or even autoclaving, which can require the combustion of fuel for the generation of steam.

Microwave	Advantages	Drawbacks
	▪ The shredding and compacting process reduces the volume of the waste ▪ Once treated, waste can be land-filled with other municipal waste ▪ No air pollution	▪ Highly sophisticated and complex ▪ Important investment and running costs ▪ Only solids can be treated and only once shredded ▪ Cannot be used to treat some special wastes such as pharmaceuticals, and cytotoxic waste ▪ Highly skilled operators required ▪ No reduction of the weight of the waste treated

Chemical disinfection, used routinely in HCFs to kill microorganisms on medical equipment has been extended to the treatment of HCW. Chemicals (mostly strong oxidants like chlorine compounds, ammonium salts, aldehydes, and phenolic compounds) are added to the waste to kill or inactivate pathogens. This treatment is most suitable for treating liquid wastes such as blood, urine, stools or hospital sewage. Thermal sterilization should nevertheless be given preference over chemical disinfection for reasons of efficiency and environmental considerations.

Chemical treatment	Advantages	Drawbacks
	▪ When applied, the shredding process reduces the volume of the waste	▪ Can't be used to treat some special wastes such as pharmaceuticals, and cytotoxic waste ▪ Highly skilled operators required ▪ Chemicals used are themselves also hazardous and require special precautions/equipment when used ▪ Final disposal must be same as for untreated special HCW ▪ Generates hazardous waste water that needs treatment

Land disposal of untreated HCW isn't recommended and should only be used as a last resort option. When this solution has to be used, it is important the HCW be disposed of in a *sanitary landfill* and rapidly covered: one technique consists in excavating a trench in mature municipal waste at the base of the working face and immediately covering it with a two-metre thick layer of fresh municipal waste.

Alternatively, a specially constructed *burial pit* can be used. Ideally it should be lined with a material of low permeability such as clay to prevent pollution of shallow groundwater and have a fence around it to prevent scavengers accessing the waste. HCW should be covered immediately with a layer of soil after each load. For added health protection and odor suppression, it is suggested that lime be spread over each waste load. Once the pit is filled, it should be sealed off.

6.1 Technique	Advantages	Drawbacks
Safe land filling Trench method (HCW is buried in a trench excavated in other waste)	▪ Simple and inexpensive to operate ▪ No specific construction costs required ▪ Operates within readily available landfill system ▪ Waste pickers are unable to access the health-care waste	▪ Special health-care waste is not treated and remains hazardous ▪ High demand for coordination between collector and landfill operator ▪ Reduces awareness amongst health-care workers of the need to segregate waste categories ▪ Potentially long/costly transportation to landfill
Safe land filling Separate disposal cells (HCW is deposited in specifically designed cells)	▪ Simple and relatively inexpensive to manage if operated in connection with existing landfill for other waste	▪ Special health-care waste is not treated and remains hazardous ▪ Requires a safe landfill with fencing ▪ Requires control of scavenging and animals ▪ Needs conscientious operation according to manual
Encapsulation (Filling containers with waste adding an immobilising material and sealing the container)	▪ Simple, low-cost and safe ▪ May be used for sharps ▪ Efficient way of reducing the risk of scavengers gaining access to the waste	▪ Not recommended for non-sharp waste ▪ Must be considered as a temporary solution
Inertization (Mixing waste with cement before disposal in order to minimise the risk of leakage of toxic substances contained in the waste)	▪ Simple, low-cost and safe ▪ May be used for pharmaceutical waste	▪ Not applicable to infectious HCW

Annexe 3
HCWM procedures to be applied in medical laboratories

The management of HCW in medical laboratories remains a sensitive issue since *highly infectious waste* of category C2 are often generated there. International standard procedures of highly infectious waste management should therefore be respected. They are summarized in the table below. Consequently, each laboratory should be equipped with the adequate material and rigorous protocols set-up to ensure a pre-treatment of the highly infectious waste before it joins the other medical waste for final treatment/disposal.

Highly infectious waste from medical laboratories, such as media or culture plates, should be collected in leak proof yellow bags or containers suitable for autoclaving and properly sealed. Ideally, each laboratory should have an autoclave room dedicated for the specific pre-treatment of this category of waste only. No office waste or other miscellaneous waste should be placed in this room, which shouldn't be either used for waste storage. Once disinfected, medical laboratory waste should be collected and treated with the infectious HCW of category C1.

If a distinct autoclave isn't available at the medical laboratory to ensure a thermal treatment, highly infectious waste should be disinfected in a solution of sodium hypochlorite in concentrated form and left overnight. It should then be discarded in a specific yellow bag, properly sealed before joining the hazardous HCW of category C1.

Step	Action
Segregation	Highly infectious waste should be: • kept in the medical area until it is pre-treated; • segregated from other general and medical waste; • placed immediately into leak-proof bags or containers.
Pre-treatment	Highly infectious waste should be immediately pre-treated (i.e. autoclaved or chemically treated) before joining the other medical waste.
Packaging	Yellow bags should be labelled with the biohazard symbol and clearly marked with the words "highly infectious waste" with a comment on whether it has been pre-treated or not.
Labelling	Yellow bags should be labelled with the name of the institution and department, type of waste, date, name and signature of person sealing the bag/container.
Storage, transport and treatment	Disinfected highly infectious waste packaged in yellow bags is no longer regarded as highly infectious and can therefore leave the medical area with other yellow-bagged waste, stored, transported and disposed of

Procedures for the management of highly infectious waste

During the handling of HCW in medical laboratories, a number of precautions should be taken to avoid cross-contamination, such as:

- The re-useable laboratory items should never be mixed with disposable ones;
- The contaminated items must be autoclaved or alternatively chemically disinfected and should never be discarded with general waste;
- Single-use/disposable laboratory items must be autoclaved and never discarded with general waste;
- All sharps (including broken glass) must be autoclaved and never discarded with general waste. They must be disposed of in approved yellow sharps containers.

Annexe 4
HCWM procedures to be applied in health-care facilities[11]

The following lines provide guidance for the implementation of HCWM plans in HCFs. The plan should be consigned in a document that contains:

- The duties and responsibilities for each category of staff within the HCF who will generate HCW or be involved in their management;
- An estimation of the quantities of hazardous and non-risk HCW generated annually;
- The human resources, equipment and budget required annually to implement the HCWM plan;
- A manual synthesising all the procedures for the management of HCW in the establishment with a special mention for the categories of HCW requiring specific treatment, such as autoclaving, before final disposal. This manual should also contain time-tables including frequency of waste collection from each ward and department, a map of the HCF showing the different collection points, storage and treatment locations;
- Monitoring procedures to trace HCW inside the HCF and to ensure HCWM rules are respected;
- Procedures to be followed by the HCF staff should be displayed at strategic points (i.e. nurse rooms, bin locations, temporary and central storage points, etc);
- Training courses and programmes for all categories of HCF staff;
- Contingency plans for storage or disposal of hazardous HCW in the event of a breakdown of the treatment/disposal facility;
- Emergency procedures in case of spillage/accidents should also be foreseen.

Are detailed hereunder the steps that should be taken at anytime to ensure a smooth implementation of a HCWM plan inside major hospitals. In minor health-care facilities, proper assignments and rigorous managerial procedures are often sufficient to ensure a smooth implementation of a limited but efficient HCWM plan. At HCF level, the development of a HCWM plan can be divided into six majors steps as described hereafter.

Step 1. Designate a coordinator

The preparation of a HCWM plan must begin with commitments from the Director of the HCF and senior directors who should designate a Health-Care Waste Management Officer (HCWMO) with overall responsibility for the development and the monitoring of the HCWM plan as well as the day-to-day operation of the HCWM system. Because (too) many committees already exist in the many HCFs, one does not recommend to create a HCWM committee at Hospital level but to assign already existing *Infection Control Committees* with the approval and periodic review of the HCWM plan.

Step 2. Conduct a HCWM Survey

A survey should be conducted on the current HCWM situation *within* the hospital in order to identify the necessary improvements. In close cooperation with head nurses from the medical departments, the HCWMO should be responsible in coordinating the survey and analysing the results as well as reviewing and assessing the existing waste management situation. In the same way the mission carried out this analysis at national level, every HCWMO should do it in his/her HCF:

- Compile general information: types of waste generated in the health-care establishment, number of beds, occupancy rates, number of medical departments, etc;
- Conduct a waste generation survey: waste composition, waste quantity, sources of generation and number of beds in use. The survey results should be presented in the form of average daily quantities of waste generated (in kg) in each HCW category from each department;
- Conduct a critical review of existing waste management practices, (i.e. segregation, storage, collection, transport, treatment and disposal);
- Quantify the number of trolleys, containers and other equipment used in waste handling, collection and transportation;
- Identify the costs related to waste management;

[11] Substantial parts of this annex are taken from the following CEHA document – 'Basic steps in the preparation of healthcare waste management for healthcare establishments' – www.healthcare.org.

- Assess existing safety (e.g. protective clothing) and security measures (e.g. in case of spills and chemicals accidents);
- Evaluate the contingency measures applied in case of a breakdown of HCW treatment units or during close down for planned maintenance (e.g. safe procedures for handling laboratory wastes in case of breakdown of the autoclave);
- Raise awareness amongst health-workers;
- Prepare drawings or sketches of the HCF showing, storage areas for hazardous and other types of waste, on-site treatment facilities, waste collection trolleys routes through the HCF (e.g. routes for transportation of general and hazardous waste outside medical department), areas for washing and disinfecting waste collection trolleys, etc;
- Prepare drawings of each medical department, floor or building showing: location of individual HCW collection points (at least for medical waste, sharps and domestic waste), location of temporary storage areas/containers, routes for internal transport of waste in medical departments (at least for hazardous waste), location of equipment for disinfection;
- Prepare drawings and specifications of: PE waste bags (thickness, width and length), containers (for medical waste and sharps, etc.), trolleys and wheeled containers for internal collection and, transport, protective clothing to be used in the handling of each category of waste (e.g. gloves, masks, plastic aprons, overalls, boots…).

Step 3. Set-up an Action Plan

Making recommendations

Based on the results obtained from Steps 1 and 2, the *Infection Control Committee* and the HCWMO should prepare recommendations on how to improve HCWM in the HCF. These recommendations should include staff responsibilities and roles, training needs, staff and equipment resources. The following are basic actions for achieving the goals of the WHO minimal programme to improve the management of HCW:

- Assessment of waste production (waste generation and composition);
- Assessment of the local handling, treatment and disposal options;
- Segregation of HCW into hazardous and general (or municipal) waste;
- Establishment of internal rules for waste handling (e.g. storage, colour coding or signs, bag/container filling, closing and labelling);
- Ensuring workers' training and safety at work (e.g. training on the safe use of chemicals for waste disinfection);
- Assignment of responsibilities within the health-care establishment;
- Choice of suitable or better treatment and disposal options.

Setting priorities for HCWM improvements

Medical departments should first focus on the safe practices/procedures for HCW segregation, internal collection and storage. *These measures have the greatest impact in reducing poor hygiene practices*. Improvements with respect to waste segregation, internal storage and collection in medical departments should consist, at least, of the following:

a) Segregation

- Separation of health-care waste into three categories (general waste, hazardous health-care waste and sharps);
- Colour coding of bags/containers to differentiate between waste categories;
- Use of posters and checklists to help segregate the waste;
- Use of labels for closed yellow-bagged waste;
- Use of holders to contain highly infectious waste bags/containers;
- Existence of safety measures (protective clothing etc.) and emergency response (in case of needle-stick injuries, etc.);
- Awareness-raising and hands-on training.

b) Internal Storage

- Separate temporary storage areas and containers for hazardous and general wastes;
- Temporary storage areas/containers located away from patient areas;
- Fixed collection schedule for temporary stored bagged waste;
- Periodic cleaning and disinfection of temporary storage areas and containers.

c) Internal transport

- Fixed collection schedule for each waste category (three-bin system) dedicated trolleys and wheeled containers (leak proof with cover) for collection and transport of hazardous waste;
- Colour coding system or (if not feasible) coloured signs for trolleys and wheeled containers to differentiate between trolleys for general and hazardous waste;
- Periodic disinfection and cleaning of trolleys and wheeled containers;
- Existence of safety measures (e.g. protective clothing) and emergency response (e.g. in case of spills, occupational injuries);
- Awareness-raising and hands-on training.

Costs associated with HCWM improvements

The cost of HCWM improvements depends upon the nature of the improvements; e.g. the total cost of introducing segregation of waste includes the cost of purchasing plastic bags and containers, of trolleys and wheeled containers and their maintenance, and of separate transportation. Waste minimization, segregation and recycling can greatly assist in the cost reductions increasingly required by HCFs, by reducing disposal costs.

As a general guideline, the final cost of HCWM improvements may consist of the following:

- Capital investment cost (e.g. purchase of trolleys and wheeled containers);
- Operating costs: labour, consumables (e.g. purchase of plastic bags);
- Cost of maintaining equipment or improving buildings (e.g. creation in medical departments of separate temporary storage areas for yellow and black-bagged waste);
- Costs of contracted HCWM services (e.g. collection of segregated waste by contractual services);
- Treatment and disposal costs (by private or public sector);
- Miscellaneous.

Implementing the proposed HCWM improvements

Arrangements for the implementation of HCWM improvements should be stated in the HCWM plan. A work plan or protocol comprising practical approaches/steps for safe implementation of waste management improvements in each medical department should be *developed by the HCWMO / Infection Control Committee* in close cooperation with the head nurses of medical departments.

It may be preferable to test the proposed HCWM improvements first in one or two departments. This approach also provides practical training for staff. Subsequently, the improvements can be extended to other parts of the HCF. The work plan for implementation of HCWM improvements in each medical department may include the following:

- Methods and timetable for implementing HCWM improvements and definition of responsibilities and roles;
- Checklists to assist nurses during the implementation process;
- Training and awareness-raising activities to introduce procedures for implementation of planned activities. The following subjects may be considered for training and awareness-raising activities: 1) proper procedures and precautions for segregation, handling, storage and disposal of hazardous HCW, 2) proper emergency procedures during a hazardous HCW spill or exposure, 3) health hazards associated with mishandling hazardous HCW, 4) organizational process for reporting hazardous materials and waste spills or exposures;
- Detailed information on safety practices and emergency response in case of incidents or accidents associated with HCWM (e.g. occupational injuries, spillage of hazardous waste, exposure to cytotoxics) and in case of disease outbreaks (e.g. cholera);
- Health surveillance and control (e.g. immunization against HBV and tetanus) and provision of information on rapid access to post exposure prophylaxis;
- Measures to control and monitor the implementation of waste management improvements. By reviewing performance data every few months modifications can be made to the waste management system;
- Contingency measures, including instructions on storage or evacuation of HCW in case of breakdown of treatment units or during close down for planned maintenance.

Step 4. Draft the HCWM plan

Based on the results of the situation assessment phase and its recommendations, the HCWMO should then draft the HCWM plan. If necessary, he/she should ask for advice, information and support from the MOH.

The content of the draft of the HCWM plan can be as simple or as complex as desired by the management of the health-care institution.

However, all HCWM plans should address the following three aspects:

- Clear and open examination of the current HCWM situation (Step 2).
- Analysis of what resources are available for improving HCWM and the possible options for improvements (Step 3).
- Preparation of a detailed set of arrangements to implement the proposed waste management improvements including:
  - arrangements for training staff;
  - acquiring new waste storage;
  - handling;
  - treatment and disposal equipment;
  - a timetable for implementation (Step 3).

An HCWM plan should show its linkage with other hospital management plans, if they exist (e.g. safety management plan, security management plan, emergency preparedness plan, equipment investment plan). Weakness in the linkages with these management plans and lack of cooperation and coordination with related executive officers may affect the effectiveness of the HCWM improvements/plan.

Step 5. Approve the HCWM plan and start implementation

The draft of the HCWM plan should be discussed by the Executive Committee and submitted for approval by the institution's management. Once approved, the implementation of the HCWM plan should be of the responsibility of the Director of the HCF. The HCWMO or the Infection Control Committee, in charge of monitoring the operation of the HCWM system, may also be delegated by the Director the responsibility for the HCWM plan implementation.

Step 6. Review the HCWM plan

- Operation of the HCWM system in HCFs cannot be efficient nor optimized in the long run unless there is a *periodic review of the HCWM plan.* With respect to the process of review it is recommended that a periodic review (e.g. every 2 years) of the HCWM plan be carried out by the Infection Control Committee.
- The infection Control Committee meets periodically (e.g. monthly) to monitor the implementation of the HCWM plan and determine whether the approved HCWM improvements need review or adjustment.

Annexe 5
Methodology to estimate the quantities of hazardous HCW produced

This document presents a simple cost effective and pragmatic methodology to estimate the annual and daily production of *hazardous HCW* generated within a country taking into account the standard type of context found in most sub-Saharan countries in Africa.

Since in many sub-Saharan countries, hazardous and non-hazardous HCW are not segregated at source but are mixed together, it is only possible to estimate the total quantities of HCW (hazardous and non-hazardous) produced and then to apply an estimated rate / ratio (that generally varies between 0.1 and 0.3) to calculate the proportion of hazardous HCW generated per hospital category.

Prerequisites and constraints

Before undertaking any survey, it is fundamental that clear and unambiguous *definitions* be decided upon regarding the classification of HCW for the following reasons:

- This enables to determine the quantities of hazardous HCW depends on what is considered as hazardous vs. non-hazardous;
- It is also indispensable, when several different teams carried out inventories in different regions / province of the country, so as to find comparable quantities between them and estimate homogenously the quantities produced at national level;

Due to often *limited funds* available to carry out such a campaign, it is all the more important to plan properly the survey. Here are a few points that can help to reduce significantly the costs:

- A team leader must be designated to coordinate the campaign in each region / province. He/she must select the HCFs to be surveyed, get into touch with them to inform them of the campaign and prepare all necessary documents (administrative authorisations, questionnaires, etc…). He/she must determine the number of pollsters, that will need to be engaged (assuming each pollster should be able to survey an approximate 10 HCFs over a period of two weeks);
- It is suggested to plan circular routes: the first week is spent collecting initial data and explaining how the questionnaires must be filled in during the following 6 days by the HCF staff. The second week, the pollster will be collecting the questionnaires and cross-checking with the HCF direction the validity of the information that has been noted down since his initial visit a week earlier.
- Once the campaign is finished, the data collected should be analysed / summarized by the team leader before being sent back to the coordinating body at national level.

To help illustrate the different steps that must be taken, an example will be developed to which one can refer. The person in charge of that specific step is mentioned in [brackets].

Step 1: inventory of all the HCFs per category and per region / province [national steering committee]

Get an as precise as possible count of the different categories of HCFs in each region / province in the country with the total number of beds in each facility. This information should normally be available at the MoH or at the regional / provincial level.

Example

To keep the example simple, we will use a fictive country made up of 4 regions / provinces, called A, B, C and D and only use four different categories of HCFs.

Step 2: select the HCFs to be surveyed [national steering committee]

According to the human and financial resources available, determine which HCFs will be visited in each region/ province. Since physical parameters such as climate, annual rainfall, etc. as well as cultural / religious aspects can have an incidence on the type and quantity of HCW produced it is important not to concentrate all the surveys in one area but try to have a wide geographical coverage.

As a first approximation, one can assume that covering 10% of the existing HCFs for each category is a minimum. We will see later how, thanks to some simple statistical analysis, one can verify if the sample surveyed was large enough.

Important parameters to be taken into account

Apart from the variation of production of HCW between *categories of HCFs* (large hospitals produce more HCW/bed/day than small HCFs), it is important to have in mind that the quantities tend to vary depending on the *day of the week* (during week-ends for example, the quantities of HCW normally decrease) and the *season* (during the rainy season for instance, the probability for a person to develop malaria and water born diseases and consequently to be treated in a hospital are higher than during the dry season).

The points mentioned above lead to the following implications:

- One will tend to visit a higher proportion of large HCFs due to the important amounts of HCW they generate;
- Surveys will have to be conducted in two campaigns, once during the *dry* and the second time during the *rainy season*, and in both cases for a *whole week* (7 days).

Example: number of HCFs selected to be surveyed at national level

	total nb of hospitals			
	in the country	selected	% of total	comments on sample
Specialised Hospital	10	5	50%	ok, should be sufficient without any problem
General Hospital	79	11	14%	ok, should be sufficient
District Hospital	129	18	14%	ok, should be sufficient
Sub-District Hospital	222	21	9%	might be too small

Step 3: collect data in the selected HCFs and analyse the results [pollsters and team leaders]

Using a survey sheet such as the one found in annexe 6, the pollster / HCF staff must report amongst others the production of hazardous HCW expressed in kg/bed/day for each HCF visited.

Quantification of HCW

In order to calculate the daily production of hazardous HCW waste generated per bed in each HCF, there are basically two methods. The first one consists in weighing all bags / bins before they are emptied / disposed of. This is the most precise option and should be used if there is an adequate scale within the HCF to perform these measurements, otherwise one can obtain a sufficiently good estimation by adding the number and estimating the volume of containers (bags, rubbish bins) used for medical waste collection in each medical unit for a defined period of time. Further discussions with the paramedical staff (overseers, nurses…) normally enables to adjust the total volume of waste collected by using a filling rate for each category of container. Finally, a volumetric mass ratio (which varies according to the type of waste thrown into the container and their humidity rate) is applied in order to estimate the total weight of HCW waste generated.

Step 4: Make a statistical analysis of the results [team leaders / steering committee]

As mentioned above, it is important to carry out a few simple statistical calculations to determine if the sample surveyed is sufficiently big and check for potentially aberrant data. One must determine:

- The ***average*** production (kg/bed/day)
  Where "*n*" is the number of HCFs (samples) surveyed per category and "*yi*" the daily production of HCW found in each sample in kg/bed/day
  $$\bar{y} = \frac{\sum_{i=1}^{i=n} y_i}{n}$$
- The ***variance***
  Provides a measure of dispersion around the average. It also provides an information on the "uncertainty" within the sample: the smaller the value of the variance, the lesser the uncertainty within the sample
  $$\sigma^2 = \frac{\sum_{i=1}^{i=n} (y_i - \bar{y})^2}{n}$$
- The ***standard deviation***
  Provides an absolute measure of the dispersion of the series around the average
  $$\sigma = \sqrt{\sigma^2}$$
- The ***coefficient of variation***
  Measures the relative dispersion (expressed in %) and provides an indication of the heterogeneity of the sample[12]
  $$CV = \frac{\sigma}{\bar{y}}$$

Example: statistical analysis at national level

						District H.		**Sub-District H.**	
sample 1	2.00	sample 1	1.23	sample 1	0.74	sample 1	0.54		
sample 2	1.70	sample 2	1.32	sample 2	0.85	sample 2	0.85		
sample 3	1.80	sample 3	1.43	sample 3	0.64	sample 3	0.70		
sample 4	1.76	sample 4	1.25	sample 4	0.84	sample 4	0.65		
sample 5	1.49	sample 5	1.25	sample 5	0.75	sample 5	0.51		
		sample 6	1.76	sample 6	0.64	sample 6	0.76		
		sample 7	1.42	sample 7	0.72	sample 7	0.64		
		sample 8	1.01	sample 8	0.69	sample 8	0.79		
		sample 9	1.25	sample 9	0.63	sample 9	0.65		
		sample 10	1.32	sample 10	0.89	sample 10	0.51		
		sample 11	1.43	sample 11	1.14	sample 11	0.79		
				sample 12	0.54	sample 12	0.65		
				sample 13	0.55	sample 13	0.76		
				sample 14	0.49	sample 14	0.63		
				sample 15	0.93	sample 15	0.63		
				sample 16	0.78	sample 16	0.62		
				sample 17	0.77	sample 17	0.66		
				sample 18	0.81	sample 18	0.46		
						sample 19	0.67		
						sample 20	0.69		
						sample 21	10.34		
Average production		**1.75**		**1.33**		**0.74**		**1.12**	
Variance		0.03		0.03		0.02		4.26	
Standard deviation		0.16		0.18		0.15		2.06	
Coefficient of variation	OK !	**9%**	OK !	**13%**	Touchy !	**21%**	Problem !	**184%**	

[12] The more a sample is heterogeneous, the more it is necessary to increase the number of HCFs to be surveyed in order to get a reliable estimation. A coefficient of variation greater than 15% in the sample should always be explained: variability due to specific characteristics of the population assessed, aberrant data, etc.

Step 5: Calculate the daily production of hazardous HCW [team leaders / steering committee]

Once a sufficient amount of data has been collected on the field and the statistical cross-checking shows it can be used with a sufficient degree of confidence, the team leaders will have to calculate for their region / province the total production of hazardous HCW produced daily per HCF category. By multiplying the daily production by the number of days that the season during which the survey was made lasts, one will get the total production for that season.

The same calculations will then be made at national level to determine the overall production of hazardous HCW in the country during that first season (in the example below the rainy season, which in our fictive country is said to last 145 days).

Example: calculation of the total production of HCW at national level during the rainy season

	kg/bed/day	Nb of beds	kg/day		Metric tons
Specialised Hospital	1.75	672	1'176		171
General Hospital	1.33	11534	15'382	145	2'230
District Hospital	0.74	3470	2'583	days of rain	375
Sub-District Hospital	1.12	3085	3'452		501
					3'276

Step 6: Carry out second campaign during the other season [steering committee, team leaders and pollsters]

Steps 3-5 will then need to be repeated about half a year later, during the other season (dry in our example).

Step 7: Cross-check and synthesis final results [steering committee / team leaders]

The total yearly production of hazardous HCW can then be determined by adding the results obtained during the rainy and dry season.

Cross-checking the results obtained with those of surveys carried out in countries with similar socio-economic characteristics is recommended and a means amongst others to verify if the results are plausible.

Analysing the variability of the production of hazardous HCW (kg/bed/day) between the different regions / provinces can also be of some interest and help not only highlighting potential errors or simply revealing different practices which can occur for climatic, cultural, etc… reasons, but also be useful for HCWM planning.

Special provisions for needles and syringes

Syringes and needles are of particular concern because they constitute an important part of the sharps and are often contaminated with the blood of patients. Sharps may not only cause cuts and punctures but also infect the wounds by agents, which previously contaminated them. Owing to this double risk of injury and disease transmission, sharps are considered problematic. It can be therefore worthwhile to estimate specifically the amount of sharps generated in each health-care facility (see annexe 6).

Such amounts can be estimated by following-up the quantities of syringes and needles delivered in each health-care facility or the quantities of syringes and needles produced / imported at national / provincial level. The estimations are therefore based on the amounts of syringes and needles received by the hospital / central pharmacy.

Annexe 6
Health-care waste management inventory questionnaires

Health-care waste management inventory **Country**

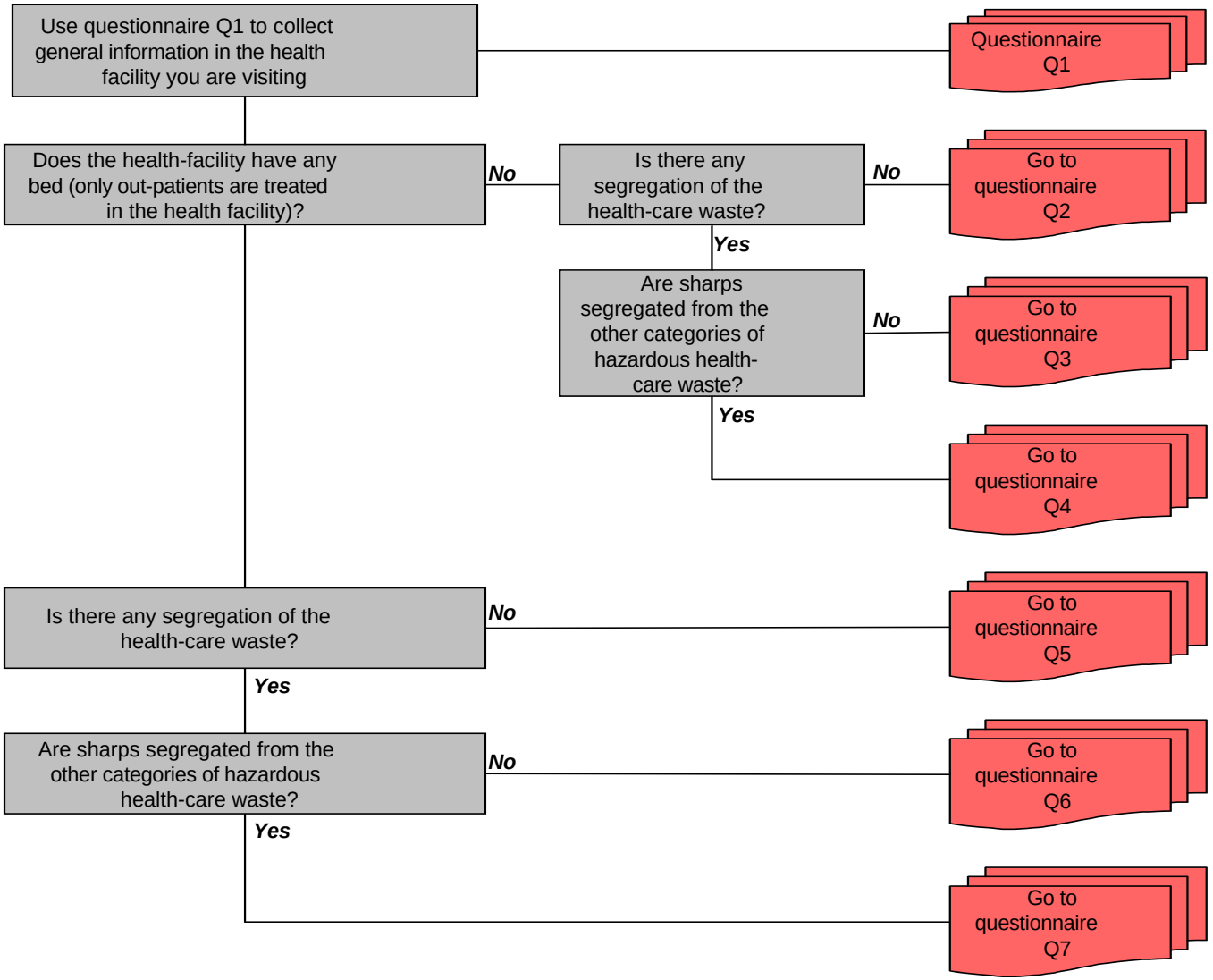
6.2 Introduction

- In the field, you will carry out survey in two different kinds of health facilities:

  a) in major health facilities where in-patients and out-patients are treated. These health facilities, such as Federal, Specialized or General Hospitals, have beds. The quantities of hazardous health-care waste generated within these health facilities can therefore be based on the weight of waste generated per bed per day;
  b) in minor or in some specialized health facilities where only out-patients are treated. These health facilities, such as blood centres, sexual transmitted disease clinics, health service posts, do not have bed. The quantities of hazardous health-care waste generated within these health facilities cannot therefore be based on the weight of waste generated per bed per day but they are based on the number of out-patients daily treated.

- Therefore, in order to simplify the collection of data within all these different categories of health-care facility, specific questionnaires have been prepared and adapted for each the different situations you will encounter in the field.
- The decision tree below will help you to select the appropriate questionnaire. Please note that questionnaire 1 has to be filed in whatever the type of health establishment you assess.
- Inventories should be carried out for at least one full week to take into consideration the weekly variability (cf. the presentation during session 4). In most situations, you should be able to show one person how to collect (note down) the information and ask this person to fill in the data for the 6 other days of the week.

6.2.1 Decision tree



Health-care waste management inventory			Country
Questionnaire 1.1	Interview	Manager or deputy of health care facility	Duration: 15"

Health care facility:	Address:	District:
Name of interviewee:	Function:	Tel. n°:
Assessment made by:		Date of assessment:

c	n°	topic	question	type	data	comments / multiple choice
	1	**health care facility (HCF)**				
	11	HCF	which category is it ?	C		[1] ambulant service; [2] (sub-)district hospital; [3] large hospital
	12	HCF	which type is it ?	C		[1] public; [2] private
	13	services	what kind of services do you provide ?	T		
	2	**staff**				
	21	medical staff training	is training of med. staff available regarding HCWM ?	B		
	22	medical staff training	if yes, what kind of training is given ?	T		
<>	**3**	**HCW off-site transport**	*if HCW is not taken off-site skip the below questions*			
<>	31	transport services	are there any control measures ?	B		[0] none; [1] transport form; [2] other (specify)
<>	32	type of transport	who does generally transport the HCW ?	C		[1] the HCF; [2] municipal service; [3] private company (name ?)
	4	**HCW treatment**	*ask to be allowed to take photos of the system !*			
	41	HCW treatment	is it treated on-site or off-site ?	C		[1] on-site; [2] off-site
<>	42	off-site HCW treatment	who's in charge with the off-site treatment ?	T		
<>	43	off-site HCW treatment	does this organisation offer satisfactory options ?	B		
	5	**HCWM regulations (code of conduct; management plan, policy...)**				
	51	HCF HCWM regulations	do you have any regulations or code of conduct ?	B		
	6	**policy and budget**				
	61	budget allocation for HCWM	which % of the HCF budget do you allocate ?	N		

Explanations	Legend for [Q]
. **Type:** data is either *quantitative* [**N**] (enter a number or percentage); *qualitative* [**Q**] (see legend); *Boolean* [**B**] (yes/no); *multiple choice* [**C**] (write down one or several numbers which correspond to the answer) or *text* [**T**] (write essential relevant poin	excellent (high) = 5
	good = 4
• All the information noted down corresponds to what the interviewee tells you. **Your personal comments** are to be put separately in the box below !	satisfactory = 3
• **Comments:** enter any relevant comments made by the interviewee which can help better understand the problematic.	insufficient = 2
• **Never leave a field empty** ! If something doesn't exist or is not applicable, put a "**0**" (zero); if the interviewee doesn't know, put a "**?**".	bad (low) = 1
• **c** (code): questions only necessary to ask when: when HCW in taken off-site (**<>**).	non-existent = 0

Personal comments/remarks of the interviewer

Health-care waste management inventory			Country
Questionnaire 1.2	**Interview**	**Head nurse & person responsible for HCWM (if any)**	**Duration: 15"**

Health care facility:	Address:	District:
Name of interviewee:	Function:	Tel. n°:
Assessment made by:		Date of assessment:

c	n°	topic	question	type	data	comments / multiple choice
	2	**staff**				
	23	staff for HCW awareness	awareness of risks of person(s) handling HCW ?	Q		
	7	**HCW segregation & handling**				
	71	needle stick injuries	how many cases reported in the past 12 months ?	N		
	72	needle handling	do you remove the needles after use ?	B		
	73	type of syringes used	what type of syringes do you use ?	C		[1] disposable; [2] sterilisable; [3] auto-disable; [4] safety syringe
	74	protective equipment	which equipment does the staff handling waste have ?	C		[0] none; [1] gloves; [2] boots; [3] apron; [4] trousers; [5] mask
	8	**HCW storage area**	*ask to be allowed to take photos of the place !*			
	81	storage area	do you have a specific area for HCW ?	B		
	82	storage area access	is the area secured ?	B		
	83	storage area organisation	are waste stored according to specific rules ?	B		
	9	**HCW collection & on-site transport**				
	91	HCW on-site transport	what kind of means do you use ?	C		[1] open device; [2] closed device; [3] other (specify)
	92	injuries/accidents	any reported cases in the past 12 months ?	B		
	10	**HCW treatment**	*ask to be allowed to take photos of the system !*			
	101	type of HCW treatment system	which kind of system is used ?	C		[0] none; [1] open fire; [2] incinerator; [3] chem. disinf.; [4] other
	102	capacity of HCW treatment syst.	what is the current capacity of the system(s) ?	N		in kg/day
	103	operation of HCW treatment syst.	any operation problems; if so for what reasons ?	C		[0] none; [1] money; [2] maintenance; [3] spare-parts; [4] other
	104	failure of HCW treatment system	what do you do when it doesn't function ?	T		

Explanations	Legend for [Q]
• **Type:** data is either *quantitative* [**N**] (enter a number or percentage); *qualitative* [**Q**] (see legend); *Boolean* [**B**] (yes/no); *multiple choice* [**C**] (write down one or several numbers which correspond to the answer) or *text* [**T**] (write essential relevant points told to you by the interviewee).	excellent (high) = 5
	good = 4
• All the information noted down corresponds to what the interviewee tells you. **Your personal comments** are to be put separately in the box below !	satisfactory = 3
• **Comments:** enter any relevant comments made by the interviewee which can help better understand the problematic.	insufficient = 2
• **Never leave a field empty** ! If something doesn't exist or is not applicable, put a "**0**" (zero); if the interviewee doesn't know, put a "**?**".	bad (low) = 1
	non-existent = 0

Health-care waste management inventory			Country
Questionnaire 2	**Data collection sheet**	**Person in charge of medical unit**	**Duration: 1h**

Health care facility:	Address:	District:
Name of interviewee:	Function:	Tel. n°:
Assessment made by:		Date of assessment (week):

Objectives

1• to characterise the health-care waste management in this kind of health-facility.

2• to quantify the amount of health-care waste generated in this kind of health facility, when they are **not segregated** and to provide an estimation in kg/day.

1• Characterization of the health-care waste management

c	n°	topic	question	type	data	comments / multiple choice
	2	**health care facility (HCF)**				
	207	out-patients	how many out-patients come each day in average?	N		
	6	**HCW storage containers**				
	600	waste containers	what kind of containers do you use ?	C		[0] no specific container; [1] plastic; [2] metallic; [3] cardboard; [4] bag; [5] box; [6] other

2 • Estimation of the daily quantity of hazardous health-care waste generated (kg/day)

2.1 • Estimation of the total volume of waste (hazardous and non-hazardous mixed together) generated during one week.

Containers		Monday			Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			
n°	volume (litres)	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	
																							Grand Total
Total (litres)																							

daily production of hazardous and non-hazardous health-care waste mixed together

2.2 • Estimation of the volume of hazardous health-care waste generated during one week (use a ratio between 0.1 and 0.3)

Ratio	
Total weekly volume of hazardous health-care waste (litres)	

2.3 • Estimation of the weight of hazardous health-care waste generated during one week (use a ratio between 0.24 and 0.31)

Ratio	
Total weekly weight of hazardous health-care waste (kg)	

2.4 • Estimation of the daily weight of hazardous health-care waste generated (divide by the number of day assessed)

Number of days assessed	
Daily production (kg/day)	

2.5 • Estimation of the daily weight of hazardous health-care waste generated per outpatient (divide by the number of outpatients)

Average number of outpatients each day	
Daily production (kg/outpatient/day)	

3 • Estimation of the daily quantity of sharps generated

3.1 • Methodology

Interview the pharmacist of the health-facility (if any) and the nurses to try to get an estimations of the number of sharps items used everyday.

One of the most relevant method to estimate the production of sharps when there are not segregated from the other categories of waste consists in getting the daily number of sharps issued from the central pharmacy of the health-facility.

The results cannot be given in kilogramms per day but in number of items per day. This enabled anyway to estimate the number of sharp boxes that should be distributed in the health facility.

3.2 • Estimation of the number of items issued by the pharmacy of the health facility

Item	Number of items							Total (week)	Average used per day	Average used per outpatient per day
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday			
Needles										
Needles and syringes assemblied										
Intravenous catheter										
Lancets										
Scalpels										
Blades										
Sutures										

Divide by 7 ↑ | divide by nb outpatients ↑

Health-care waste management inventory			Country
Questionnaire 3	Data collection sheet	Person in charge of medical unit	Duration: 1h
Health care facility:	Address		District:
Name of interviewee:	Functior		Tel. n°:
Assessment made by:			Date of assessment (week):

Objectives

1• to characterise the health-care waste management in this kind of health-facility.

2• to quantify the amount of health-care waste generated in this kind of health facility, when they are **segregated** and to provide an estimation in kg/day.

1• Characterization of the health-care waste management

n°	topic	question	type	data	comments / multiple choice
2	health care facility (HCF)				
21	out-patients	how many out-patients come each day in average?	N		
6	HCW storage containers				
61	waste containers	what kind of containers do you use ?	C		[0] no specific container; [1] plastic; [2] metallic; [3] cardboard; [4] bag; [5] box; [6] other
62	colour coding	do you have a specific colour coding system ?	B		

2 • Estimation of the daily quantity of hazardous health-care waste generated (kg/day)

2.1 • Estimation of the total volume of hazardous health-care waste generated during one week.

Containers		Monday			Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			
n°	volume (litres)	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	
																							Grand Total
Total (litres)																							

daily production of hazardous and non-hazardous health-care waste mixed together

2.2 • Estimation of the weight of hazardous waste generated durin (use a ratio between 0.24 and 0.31)

Ratio	
Total weekly weight of hazardous health-care waste (kg)	

2.3 • Estimation of the daily weight of hazardous waste generated (divide by the number of day assessed)

Number of days assessed	
Daily production (kg/day)	

2.4 • Estimation of the daily weight of hazardous health-care waste generated per outpatient (divide by the number of outpatients)

Average number of outpatients each day	
Daily production (kg/outpatient/day)	

3 • Estimation of the daily quantity of sharps generated

3.1 • Methodology

Interview the pharmacist of the health-facility (if any) and the nurses to try to get an estimations of the number of sharps items used everyday.
One of the most relevant method to estimate the production of sharps when there are not segregated from the other categories of waste consists in getting the daily number of sharps issued from the central pharmacy of the health-facility.

The results cannot be given in kilogramms per day but in number of items per day. This enabled anyway to estimate the number of sharp boxes that should be distributed in the health facility.

3.2 • Estimation of the number of items issued by the pharmacy of the health facility

Item	Number of items							Total (week)	Average used per day	Average used per outpatient per day
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday			
Needles										
Needles and syringes assem										
Intravenous catheter										
Lancets										
Scalpels										
Blades										
Sutures										
									Divide by 7	divide by nb outpatients

Health-care waste management in			Nigeria
Questionnaire 4	Data collection sheet	Person in charge of medical unit	Duration: 1h
Health care facility:	Address:		District:
Name of interviewee:	Function:		Tel. n°:
Assessment made by:			Date of assessment (week):

Objectives

1• to characterise the health-care waste management in this kind of health-facility.

2• to quantify the amount of health-care waste generated in this kind of health facility, when they are **segregated** (including sharps) and to provide an estimation in kg/day.

1• Characterization of the health-care waste management

c	n°	topic	question	type	data	comments / multiple choice
		2 health care facility (HCF)				
	207	out-patients	how many out-patients come each day in average?	N		
		6 HCW storage containers				
	600	waste containers	what kind of containers do you use ?	C		[0] no specific container; [1] plastic; [2] metallic; [3] cardboard; [4] bag; [5] box; [6] other
	601	sharp containers	what kind of containers do you use ?	C		
	602	shortage of sharps cor	for what reasons are there shortages, if any ?	C		
	603	colour coding	do you have a specific colour coding system?	B		

2 • Estimation of the daily quantity of hazardous (non-sharps) health-care waste generated (kg/day)

2.1 • Estimation of the total volume of hazardous (non-sharps) health-care waste generated during one week.

Containers		Monday			Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			
n°	volume (litres)	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	
																							Grand Total
Total (litres)																							
daily production of hazardous and non-hazardous health-care waste mixed together																							

2.3 • Estimation of the weight of hazardous (non-sharps) health-care waste generated during one week (use a ratio between 0.24 and 0.31)

Ratio	
Total weekly weight of hazardous health-care waste (kg)	

2.4 • Estimation of the daily weight of hazardous (non-sharps) health-care waste generated (divide by the number of day assessed)

Number of days assessed	
Daily production (kg/day)	

2.5 • Estimation of the daily weight of hazardous health-care waste generated per outpatient (divide by the number of outpatients)

Average number of outpatients each day	
Daily production (kg/outpatient/day)	

3 • Estimation of the daily quantity of sharps generated (kg/day) gnerated in the health facility UNIT :

3.1 • Estimation of the total volume of sharps generated during one week.

Containers		Monday			Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			
n°	volume (litres)	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	
																							Grand Total
Total (litres)																							

daily production of hazardous and non-hazardous health-care waste mixed together

3.2 • Estimation of the weight of sharps generated durin (use a ratio between 0.45 and 0.56)

Ratio	
Total weekly weight of sharps (kg)	

3.3 • Estimation of the daily weight ofsharps generated (divide by the number of day assessed)

Number of days assessed	
Daily production (kg/day)	

3.4 • Estimation of the daily weight of sharps generated per outpatient (divide by the number of outpatients)

Average number of outpatients each day	
Daily production (kg/outpatient/day)	

Health-care waste management inventory			Country
Questionnaire 5	Data collection sheet	Person in charge of me	Duration: 1h
Health care facility:	Address:		District:
Name of interviewee:	Function		Tel. n°:
Assessment made by:		Date of assessment (week):	

Objectives

1• to characterise the health-care waste management in this kind of health-facility.

2• to quantify the amount of health-care waste generated in this kind of health facility, when they are **not segregated** and to provide an estimation in kg/day/day.

1• Characterization of the health-care waste management

c	n°	topic	question	type	data	comments / multiple choice
		2 health care facility (HCF)				
	204	bed capacity	how many beds do you have in total ?	N		
	206	occupancy	what is the average bed occupancy rate ?	N		
		6 HCW storage containers				
	600	waste containers	what kind of containers do you use ?	C		[0] no specific container; [1] plastic; [2] metallic; [3] cardboard; [4] bag; [5] box; [6] other

2 • Estimation of the daily quantity of hazardous health-care waste generated (kg/bed/day)

2.1 • Estimation of the total volume of waste (hazardous and non-hazardous mixed together) generated during one week.

Containers		Monday			Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			
n°	volume (litres)	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	
																							Grand Total
Total (litres)																							
daily production of hazardous and non-hazardous health-care waste mixed together																							

2.2 • Estimation of the volume of hazardous (use a ratio between 0.1 and 0.3)

Ratio	
Total weekly volume of hazardous health-care waste (litres)	

2.3 • Estimation of the weight of hazardous v (use a ratio between 0.24 and 0.31)

Ratio	
Total weekly weight of hazardous health-care waste (kg)	

2.4 • Estimation of the daily weight of hazarc (divide by the number of day assessed)

Number of days assessed	
Daily production (kg/day)	

2.4 • Estimation of the daily weight of hazarc (divide by the total number of beds)

Total number of beds	
Daily production (kg/bed/day)	

3.1 • Methodology

Interview the pharmacist of the health-facility (if any) and the nurses to try to get an estimations of the number of sharps items used everyday.

One of the most relevant method to estimate the production of sharps when there are not segregated from the other categories of waste consists in getting the daily number of sharps issued from the central pharmacy of the health-facility.

The results cannot be given in kilogramms per day but in number of items per day. This enabled anyway to estimate the number of sharp boxes that should be distributed in the health facility.

3.2 • Estimation of the number of items issued by the pharmacy of the health facility

Item	Number of items							Total (week)	Average used per day	Average used per bed per day
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday			
Needles										
Needles and syringes assemblied										
Intravenous catheter										
Lancets										
Scalpels										
Blades										
Sutures										

Divide by 7

divide by nb of beds

Health-care waste management inventory			Country
Questionnaire 6	Data collection sheet	Person in charge of medical	Duration: 1h
Health care facility:	Address:		District:
Name of interviewee:	Function:		Tel. n°:
Assessment made by:			Date of assessment (week):

Objectives

1• to characterise the health-care waste management in this kind of health-facility.

2• to quantify the amount of health-care waste generated in this kind of health facility, when they are **segregated** and to provide an estimation in kg/day/day.

1• Characterization of the health-care waste management

c	n°	topic	question	type	data	comments / multiple choice
	2	**health care facility (HCF)**				
	204	bed capacity	how many beds do you have in total ?	N		
	206	occupancy	what is the average bed occupancy rate ?	N		
	6	**HCW storage containers**				
	600	waste containers	what kind of containers do you use ?	C		[0] no specific container; [1] plastic; [2] metallic; [3] cardboard; [4] bag; [5] box; [6] other
	603	colour coding	do you have a specific colour coding system ?	B		

2 • Estimation of the daily quantity of hazardous health-care waste generated (kg/bed/day) in the Medical Units **UNIT :**

2.1 • Estimation of the total volume of hazardous waste generated during one week.

Containers		Monday			Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			
n°	volume (litres)	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	Grand Total
Total (litres)																							

daily production of hazardous and non-hazardous health-care waste mixed together

2.3 • Estimation of the weight of hazardous waste generated during o (use a ratio between 0.24 and 0.31)

Ratio

Total weekly weight of hazardous health-care waste (kg)

2.4 • Estimation of the daily weight of hazardous waste generated (divide by the number of day assessed)

Number of days assessed

Daily production (kg/day)

3 • Estimation of the quantity of hazardous health-care waste generated at the health facility level (kg/bed/day) : synthesis of the results collected in each Medical Unit

3.1 • Synthesis of the results collected in each Medical Unit

Medical Unit		Daily production
n°	Name	(kg/day)
Total		

3.2 • Estimation of the daily weight of hazardous waste generated per bed at health facility level

(divide by the total number of beds)

Total number of beds	
Daily production (kg/bed/day)	

4 • Estimation of the daily quantity of sharps generated

4.1 • Methodology

Interview the pharmacist of the health-facility (if any) and the nurses to try to get an estimations of the number of sharps items used everyday.

One of the most relevant method to estimate the production of sharps when there are not segregated from the other categories of waste consists in getting the daily number of sharps issued from the central pharmacy of the health-facility.

The results cannot be given in kilogramms per day but in number of items per day. This enabled anyway to estimate the number of sharp boxes that should be distributed in the health facility.

4.2 • Estimation of the number of items issued by the pharmacy of the health facility

Item	Number of items							Total (week)	Average used per day	Average used per bed per day
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday			
Needles										
Needles and syringes assemblied										
Intravenous catheter										
Lancets										
Scalpels										
Blades										
Sutures										

Divide by 7 | divide by nb of beds

Health-care waste management inventory			Country
Questionnaire 7	Data collection sheet	Person in charge of medical ur	Duration: 1h
Health care facility:	Address:	District:	
Name of interviewee:	Function:	Tel. n°:	
Assessment made by:		Date of assessment (week):	

Objectives

1• to characterise the health-care waste management in this kind of health-facility.

2• to quantify the amount of health-care waste generated in this kind of health facility, when they are **segregated (including sharps)** and to provide an estimation in kg/day/day.

1• Characterization of the health-care waste management

c	n°	topic	question	type	data	comments / multiple choice
		2 health care facility (HCF)				
	204	bed capacity	how many beds do you have in total ?	N		
	206	occupancy	what is the average bed occupancy rate ?	N		
		6 HCW storage containers				
	600	waste containers	what kind of containers do you use ?	C		[0] no specific container; [1] plastic; [2] metallic; [3] cardboard; [4] bag; [5] box; [6] other
	601	sharp containers	what kind of containers do you use ?	C		
	602	shortage of sharps containers	for what reasons are there shortages, if any ?	C		
	603	colour coding	do you have a specific colour coding system ?	B		

2 • Estimation of the daily quantity of hazardous health-care waste (non-sharps) generated (kg/bed/day) in the Medical Units	UNIT :	

2.1 • Estimation of the total volume of hazardous health-care waste (non-sharps) generated during one week.

Containers		Monday			Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday		
n°	volume (litres)	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total
Total (litres)																						
daily production of hazardous and non-hazardous health-care waste mixed together																						

2.2 • Estimation of the weight of hazardous waste generated (use a ratio between 0.24 and 0.31)

Ratio	
Total weekly weight of hazardous health-care waste (kg)	

2.3 • Estimation of the daily weight of hazardous waste gener (divide by the number of day assessed)

Number of days assessed	
Daily production (kg/day)	

3 • Estimation of the daily quantity of sharps generated (kg/bed/day) in the Medical Units	UNIT :	

3.1 • Estimation of the total volume of sharps generated during one week.

Containers		Monday			Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			
n°	volume (litres)	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	nb emptied	filling rate	Total	
																							Grand Total
Total (litres)																							

daily production of hazardous and non-hazardous health-care waste mixed together

3.2 • Estimation of the weight of sharps generated during one (use a ratio between 0.45 and 0.56)

Ratio	
Total weekly weight of sharps (kg)	

3.3 • Estimation of the daily weight ofsharps generated (divide by the number of day assessed)

Number of days assessed	
Daily production (kg/day)	

4 • Estimation of the quantity of hazardous health-care waste generated at the health facility level (kg/bed/day) : synthesis of the results collected in each Medical Unit

4.1 • Synthesis of the results collected in each Medical Unit

Hazardous health-care waste (non sharps)		
Medical Unit		Daily production
n°	Name	(kg/day)
Total		

Sharps		
Medical Unit		Daily production
n°	Name	(kg/day)
Total		

4.2 • Estimation of the daily weight of hazardous waste generated per bed at health facility level

(divide by the total number of beds)

Total number of beds	
Daily production (kg/bed/day)	

Total number of beds	
Daily production (kg/bed/day)	

Annexe 7
Glossary of terms commonly used in HCWM

term	definition
activity	disintegration of an amount of a radionuclide in a particular energy state at a given time per time interval at a given moment
air pollution	the presence of a material or substance in the air which may be harmful to either the natural or human environment, which includes any material present in sufficient concentrations for a sufficient time, and a number of circumstances, to interfere significantly with the comfort, health or welfare of persons or with the full use and enjoyment of property
air quality standards	the level of pollutants that cannot by law be exceeded during a specified time in a defined area
anatomic waste	consisting of recognizable body parts
biomedical and health-care waste	solid or liquid waste arising form health-care (medical) activities such as diagnosis, monitoring, treatment, prevention of disease or alleviation of handicap in humans or animals, including related research, performed under the supervision of a medical practitioner or veterinary surgeon or another person authorized by virtue of his professional qualifications
bottom ash	the non-airborne combustion residue from burning fuel and other materials in an incinerator. The material falls to the bottom of the incinerator and is removed mechanically
capacity	the quantity of solid waste that can be processed in a given time under certain specified conditions, usually expressed in terms of mass per 24 hours
chemical waste	consisting of/or containing chemical substances
collection	the act of removing accumulated containerized solid waste from the generating source. Private collection of solid and liquid waste by individuals or companies from residential, commercial, health facility or industrial premises. The arrangements for the service are made directly between the owner or occupier of the premises and the collector
container	vessel in which waste is placed for handling, transportation, storage and/or eventual disposal. The waste container is a component of the waste package
cytotoxic waste	drugs possessing a specific destructive action on certain cells
decontamination	the process of reducing or eliminating the presence of harmful substances such as infectious agents so as to reduce the likelihood of disease transmission from those substances
disinfectant	chemical agent that is able to reduce the viability of micro-organisms

term	definition
disposal	intentional burial, deposit, discharge, dumping, placing or release of any waste material into or on any air, land or water
exposure	the amount of radiation or pollutant present in a particular environment (i.e. human, natural) which represents a potential health threat to the living organisms in that environment
fly ash	the finely divided particles of ash entrained in the flue gases arising from combustion. The particles of ash may contain incompletely burned material. The particles are frequently glassy spheres but may also be crystalline or even fibrous in structure
handling	the functions associated with the movement of waste materials
health-care wastes with high content of heavy metals	consists of materials and equipment which include heavy metals and derivatives in their structure
incineration	the controlled burning of solid, liquid or gaseous combustible wastes to produce gases and residues containing little or no combustible material
irradiation	exposure to radiation of wavelengths shorter than those of visible light (gamma, x-ray or ultraviolet) for medical purposes, the destruction of bacteria in milk or other foodstuffs or initiation of polymerization of monomers or vulcanization of rubber
infectious health-care waste	discarded materials from health-care activities on humans or animals which have the potential of transmitting infectious agents to humans. These include discarded materials or equipment from the diagnosis, treatment and prevention of disease, assessment of health status or identification purposes, that have been in contact with blood and its derivatives, tissues, tissue fluids, or wastes from infection isolation wards
minimization (of waste)	the application of activities such as waste reduction, reuse and recycling to minimize the amount of waste that requires disposal.
monitoring	periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, animals and other living things
off-site facility	a clinical and related waste treatment, storage or disposal facility that is located away from the generating site
on-site facility	a clinical and related waste treatment, storage or disposal facility that is located on the generating site
open dump	characterized by the uncontrolled and scattered deposit of wastes
pharmaceutical waste	consisting of/or containing pharmaceuticals
pressurized containers	consists of containers (full or empty) with pressurized liquid, gas or powdered materials
pyrolysis	the decomposition of organic material by heat in the absence of or with limited supply of oxygen

term	definition
radioactive waste	material contaminated with a radioisotope which arises from the medical or research use of radionuclides. It may be in a solid, liquid or gaseous form
recycling	a term embracing the recovery and reuse of scrap or waste material for manufacturing or other purposes
residual waste	those materials (solid or liquid) which still require disposal after the completion of a treatment or resource recovery activity (e.g. slag and liquid effluents following a pyrolysis operation and the discards from front-end separation systems
risk	probability that a hazard will cause harm and the severity of that harm
sanitary landfill	characterized by the controlled and organized deposit of wastes which is then covered regularly (daily) by the staff present on site. Appropriate engineering preparations of the site and a favourable geological setting (providing an isolation of wastes from the environment) are required
sanitation	the control of all the factors in the physical environment that exercise or can exercise a deleterious effect on human physical development, health and survival
segregation	the systematic separation of waste into designated categories
sharps	sharps are a subcategory of infectious health care waste and include objects that are sharp and can cause injuries
sterilization	a process used to reach a state of free of viable micro-organisms. Note that in a sterilization process, the nature of microbiological death or reduction is described by an experimental function. Therefore, the number of micro-organisms that survive a sterilization process can be expressed in terms of probability. While the probability may be reduced to a very low number, it can never be reduced to zero
storage	the placement of waste in a suitable location or facility where isolation, environmental and health protection and human control (e.g. monitoring for radioactivity, limitation of access) are provided. This is done with the intention that the waste will be subsequently retrieved for treatment and conditioning and/or disposal (or clearance of radioactive waste)
treatment	any method, technique or process for altering the biological, chemical or physical characteristics or waste to reduce the hazards it presents and facilitate, or reduce the costs of, disposal. The basic treatment objective include volume reduction, disinfection, neutralization or other change of composition to reduce hazards, including removal or radionuclides from radioactive waste
waste management	all the activities - administrative and operational - involved in the handling, treatment, conditioning, storage, transportation and disposal of waste

The Secretariat of the Basel Convention and the World Health Organization are extremely grateful to the following experts for their valuable contributions to this manual:

- Mr Franck Bouvet, Emergence
- Mr. Mark Haltmeier, Emergence
- Dr Oludayo Dada, Head of Industrial Compliance and Hazardous Chemical Division, Federal Ministry of Environment, Nigeria
- Ms. Thembisile Kumalo, Department of Environmental Affairs and Tourism, South Africa
- Mr Oumar Cisse, Director, Institut African de Gestion Urbaine, Senegal

The individuals from the World Health Organization having participated in the preparation of the manual include:

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- Mr. Raki Zghondi , WHO-Regional Office for the Eastern Mediterranean

The individuals from the secretariat of the Secretariat of the Basel Convention having participated in the preparation of the manual include:

- Mr. Vincent Jugault, Programme Officer
- Ms. Sara de Pablo, Environmental Specialist