National Health Care Waste Management Guideline

Health Protection Agency

Ministry of Health
Republic of Maldives

National Health Care Waste Management Guideline

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FOREWORD

The National Health Care Waste Management Guideline gives importance to the proper waste segregation and handling in healthcare settings to prevent the spread of infections, exposure to toxins, and injuries among healthcare professionals and waste handlers. Improper management of healthcare waste is not only a health risk but also contributes to Greenhouse Gas emissions and environmental pollution. To mitigate these risks, the guideline emphasizes the need for healthcare facilities in the Maldives to follow national standards and best practices for waste management.

The primary objective is to offer health care facility managers, workers, and relevant national agencies, practical, step-by-step guidelines for managing health care waste. This aims to ensure safety precautions are consistently applied to protect both human health and the environment.

All health care facilities, whether offering major or minor services, should strictly follow these guidelines to safely manage waste throughout the handling process. Ensuring safe waste management at every step is critical for the health and safety of both staff and patients.

I would like to expresses gratitude for the collaborative efforts that contributed to developing this health care waste management guideline. Appreciation is extended to the various divisions and departments of the Ministry of Health, public and private healthcare institutions, other Government organizations, and partner agencies for their support. We are very grateful for the technical and financial support by the World Health Organization (WHO) for the development of this guideline.

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HCF	Health Care Facility
HCW	Health Care Waste
HCWM	Health Care Waste Management
HCWMC	Health Care Waste Management Committee
HCWMP	Health Care Waste Management Plan
HPA	Health Protection Agency
MFDA	Maldives Food and Drug Authority
MoH	Ministry of Health
WHO	World Health Organization

Chapter 1: INTRODUCTION

1.1 Background

Healthcare waste (HCW) is a by-product of health care that includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices and radioactive materials. Wastes from operating rooms (human tissue, blood- or blood-soaked sponges, gauze or cotton) and laboratories (blood, feces, sputum, urine specimens and microbiological cultures) should be considered contaminated. Soiled medical devices or items that can inflict injury (e.g., used needles and scalpel blades) are capable of spreading blood borne diseases such as hepatitis B, hepatitis C and HIV, and are also considered contaminated waste. [1]

Wastes from hospitals and healthcare facilities may be contaminated/potentially infectious or non-contaminated. Contaminated wastes, if not disposed properly, may carry microorganisms that can infect people who come in contact with the waste. Approximately 85% of the general waste produced by hospitals and clinics are non-contaminated waste and cause no infectious risk to healthcare workers and waste handlers.[1] Examples of non-contaminated waste include paper, boxes, bottles, plastic containers and food.

Poor management of HCW potentially exposes health care workers, waste handlers, patients and the community at large to infection, toxic effects and injuries, and risks polluting the environment. Unsafe disposal and treatment of HCW will also contribute to the Greenhouse Gas emissions contributing to global climate change. Therefore, it is essential that all medical waste materials are segregated at the point of generation, appropriately treated and disposed of safely.

The purpose of the guideline is to provide step by step guidance to the Health Care Facility (HCF) managers, health care professionals, waste handlers and all personals involved in

collection, transportation and disposal of health care waste to ensure the wastes are collected, handled and managed safely to minimize the adverse impacts to human health and the environment.

1.2 Objectives of the guideline

1.2.1 Specific Objectives

1. To protect the patients, employees, visitors and the general public by reducing the exposures from the hazardous health care waste.
2. To ensure all health care facilities follow safe waste management practices and demonstrate commitment to public health and environmental protection.

1.2.2 Application

The National Health Care Waste Management Guideline applies to all public and private health care facilities/institutions, research facilities, veterinary facilities, home, traditional and religious care facilities.

Chapter 2: HEALTH CARE WASTE

2.1 General Definition

The Term "Health Care Waste" (HCW) refers to all types of wastes generated in a Health Care Facility (HCF), research centers and laboratories related to medical procedures. In addition, it also includes the same types of waste generated from minor sources, such as home health care, dental care, long term facility care, etc.

Between 75% and 90% of the waste produced by health-care provider's is called "non-hazardous" or "general health-care waste". It comes mostly from the administrative, kitchen and housekeeping functions at health-care facilities and may also include packaging waste and waste generated during maintenance of health-care buildings (Figure 2.1). The remaining 10–25% of health-care waste is regarded as "hazardous" and may pose a variety of environmental and health risks[1].

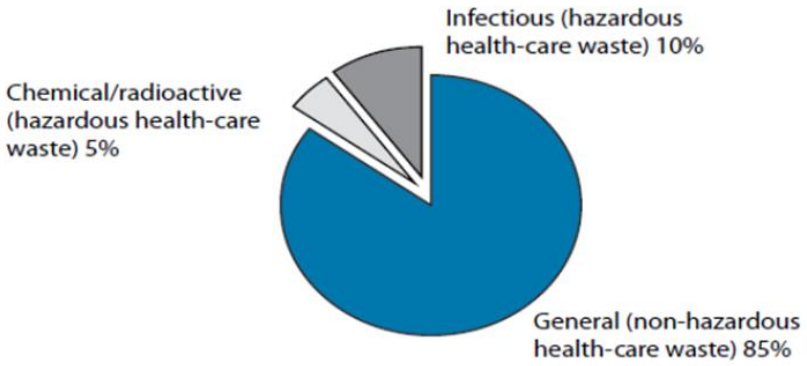


Figure 2.1: Typical waste compositions in health-care facilities

2.2 Health and environmental impacts associated with health care waste

Unsafe handling and disposal of health care waste poses various health risks to the health care professionals and public. Improper disposal can also pollute the environment due to the contamination of groundwater, soil or by releasing toxic gasses such as dioxin and furan along with heavy toxic metals like mercury, cadmium and lead.

2.2.1 Persons at risk

- All individuals that come in contact with hazardous health-care waste are potentially at risk including[1];
  - Medical doctors, nurses, hospital maintenance personnel
  - Patients in HCF's / persons receiving home care
  - Visitors and caregivers to health care facilities
  - Support services workers, such as cleaners, laundry workers, porters
  - workers transporting waste to a treatment or disposal facility
  - Workers in waste-management facilities (such as landfills or treatment plants), scavengers
  - General public

2.2.2 Types of hazards

- The hazardous nature of health-care waste is due to one or more of the following characteristics[1]:
  - presence of infectious agents
  - a genotoxic or cytotoxic chemical composition
  - presence of toxic or hazardous chemicals or biologically aggressive pharmaceuticals
  - presence of radioactivity
  - presence of used sharps

2.3 Categories of Health Care Waste

The figure 2.2 illustrates the categories of health care waste generated in a health care facility

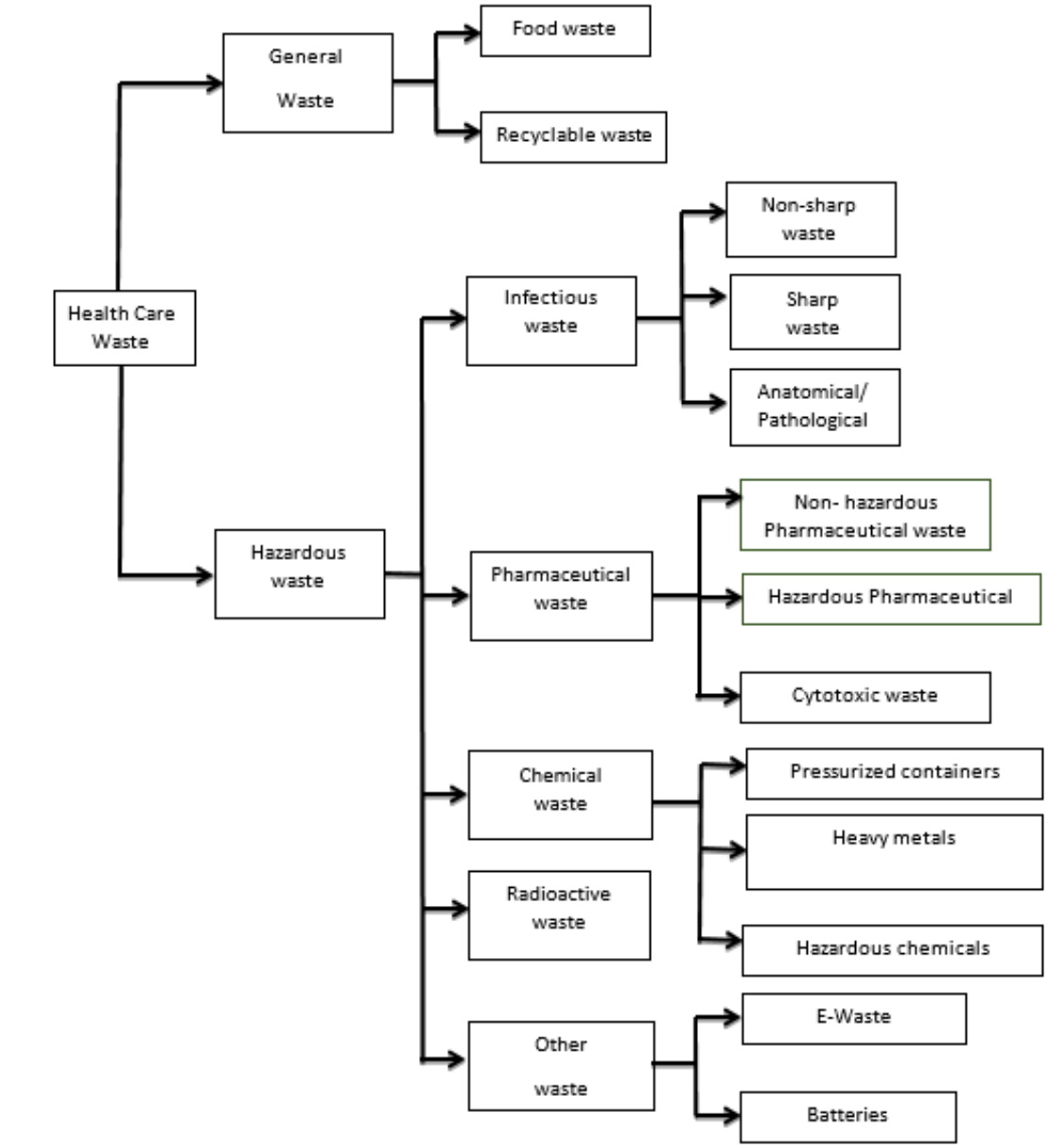


Figure 2.2: Categories of Health Care Waste

2.3.1 General waste

- General waste includes food waste and general waste (office wastes, packing materials, metal, glass, textiles, plastics, paper, etc). This type of wastes is free of hazardous substance or pathogenic microorganisms and do not require special handling or treatment.
- General waste should be collected regularly by the municipality/contractors from the facility and transported to a designated municipal disposal site in the island.
- Management of general waste should comply with the national waste management regulation and standards

Note: If non-hazardous/general waste is mixed with infectious waste in any segregation point or collection point, this waste should be treated as INFECTIOUS WASTE

2.3.2 Infectious waste

- Infectious wastes are materials that are susceptible to contain pathogens (bacteria, viruses, parasites or fungi) in sufficient concentration to cause diseases in susceptible hosts are considered as infectious waste. Some of the examples are listed in table 2.1.
- This type of waste is further divided into, non-sharp, sharp anatomical, pathological offensive human wastes
- Pathogenic microorganisms from infectious waste may enter the body through puncture, abrasion or cut in the skin, mucus membranes, inhalation, ingestion. Laboratory cultures, used sharps can cause cuts or puncture wounds and are considered highly hazardous and can infect the wounds if contaminated with pathogens.

Accidental needle stick injuries, reuse of improperly discarded needles by waste pickers/IV users could lead to spread of hepatitis, HIV and other blood-borne diseases.

Table 2.1: Description and Examples of infectious waste

Infectious waste	Description and Examples
Non-sharps waste	Waste contaminated with blood or other body fluids such as dressing, bandages, swabs, gloves, masks, gowns, drapes and other materials
	Laboratory cultures including contaminated culture dishes, glass plates, vials, tissue cultures
	Waste from infected patients excreta, dressing from infected or surgical wounds, and clothes heavily soiled with human blood or other body fluids
Sharps waste	Used or unused sharps (e.g. hypodermic, intravenous or other types of needles; auto-disable syringes; scalpels; pipettes; broken glass, etc.)
Anatomical	Anatomical waste includes body parts, limbs, placenta, products of conception, body organs
Pathological waste	Pathological waste consists of tissues, blood, body fluids and other waste from surgery and autopsies on patients with infectious diseases.
Offensive human wastes	Nappies, sanitary products

2.3.3 Pharmaceutical waste including genotoxic waste

a. Pharmaceutical waste

- Pharmaceutical waste includes non-hazardous pharmaceutical waste and hazardous pharmaceutical waste.
    - **Non-hazardous pharmaceutical waste** includes normal saline, sugar, drips, nutrient solutions, etc., poses no hazard during collection or storage.
    - **Hazardous pharmaceutical waste** such as epinephrine, nicotine, warfarin, etc., poses a hazard when improperly used by unauthorized persons.
- This category also includes discarded items heavily contaminated during the handling of pharmaceuticals, such as bottles, vials and boxes containing pharmaceutical residues, gloves, masks and connecting tubing.[1]

b. Cytotoxic waste

- Cytotoxic are the most hazardous pharmaceutical waste and are capable of impairing, injuring and killing cells. They also can have direct irritant effects on skin, eyes, mucous membrane and other tissues.
- This type of wastes should be handled very carefully as very small quantities can be hazardous.

2.3.4 Chemical waste

- Chemical waste consists of discarded chemicals (solid, liquid or gaseous) that are used during disinfecting procedures or cleaning processes. The hazardous properties most relevant to waste from health care are as follows.[1]
- These types of wastes are considered hazardous if it has at least one of the following properties:
    - Toxic
    - Corrosive
    - Flammable

- Reactive
- Oxidizing

- The most common types of hazardous chemicals used in HCF's include formaldehyde, solvents used for pathology and histology, disinfecting and cleaning solutions, etc.
- Wastes from heavy metals such as mercury is highly toxic substance.
- The general classes of chemical waste found in health care facilities is listed in Table 2.2. [1]

Table 2.2: Examples of chemical wastes from health care activities

Chemical waste	Examples
Halogenated solvents	Chloroform, methylene chloride, perchloroethylene, refrigerants, trichloroethylene
Non-halogenated solvents	Acetone, acetonitrile, ethanol, ehtylacetate, formaldehyde, isopropanol, methanol, toluene, xylenes
Halogenated disinfectants	Calcium hypochlorite, chlorine dioxide, iodine solutions, iodophors, sodium dicholoroisocyanurate, sodium hypochlorite (bleach)
Aldehydes	Formaldehyde, glutaraldehydes, ortho-phthaladehyde
Alcohols	Ethanol, isopropanol, phenols
Other disinfectants	Hydrogen peroxide, peroxyacetic acid, quarternary amines
Metals	Arsenic, cadmium, chromium, lead, mercury, silver
Acids	Acetic, chromic, hydrochloric, nitric sulfuric
Bases	Ammonium hydroxide, potassium hydroxide, sodium hydroxide
Oxidizers	Bleach, hydrogen peroxide, potassium dichromate, potassium permanganate
Reduces	Sodium bisulfite, sodium sulfite
Miscellaneous	Anesthetic gasses, asbestos, ethylene oxide, herbicides, paints, pesticides, waste oils

2.3.5 Radioactive waste

- Radioactive wastes are materials contaminated with radionuclides produced in procedures such as in vitro analysis of body tissue and fluid, in vivo organ imaging and tumor localization, and during other analytical and therapeutic practices.[1]

- This category includes disused sealed radiation sources, liquid and gaseous materials contaminated with radioactivity, excreta of patients who underwent radionuclide diagnostic and therapeutic applications, test tubes, needles, syringes, straws, paper cups and washings of such things.[2]
- Radioactive health care waste often contains radionuclides with short half-lives, which loses its radioactivity relatively quickly (i.e. half of the radionuclide content decays in hours or a few days. [1]
- The waste produced by health-care and research activities involving radionuclides and related equipment maintenance and storage can be classified as follows[1]:
    - sealed sources;
    - spent radionuclide generators;
    - low-level solid waste (e.g. absorbent paper, swabs, glassware, syringes, vials);
    - residues from shipments of radioactive material and unwanted solutions of radionuclides intended for diagnostic or therapeutic use;
    - liquid immiscible with water, such as liquid scintillation counting;
    - residues used in radioimmunoassay, and contaminated pump oil;
    - waste from spills and from decontamination of radioactive spills;
    - excreta from patients treated or tested with unsealed radionuclides;
    - low-level liquid waste (e.g. from washing apparatus);
    - gases and exhausts from stores and fume cupboards.
- The illness caused by radioactive waste is determined by the type of exposures and can range from headache, dizziness and vomiting to much more serious problems. Radioactive waste is also genotoxic, and a sufficiently high radiation dose may also affect genetic material. [1]

2.3.6 Other types of waste

Other types of waste generated in a health care facility include electronic waste (discarded electronic and electrical devices) and used batteries. These types of wastes

should be segregates, stored separately and transported and disposed according to the National waste management regulations and standards.

2.4 Sources of Health Care Waste

Different types of health-care facilities can be viewed as major or minor sources of health-care waste, according to the quantities produced but not limited to as listed in below Table 2.3.

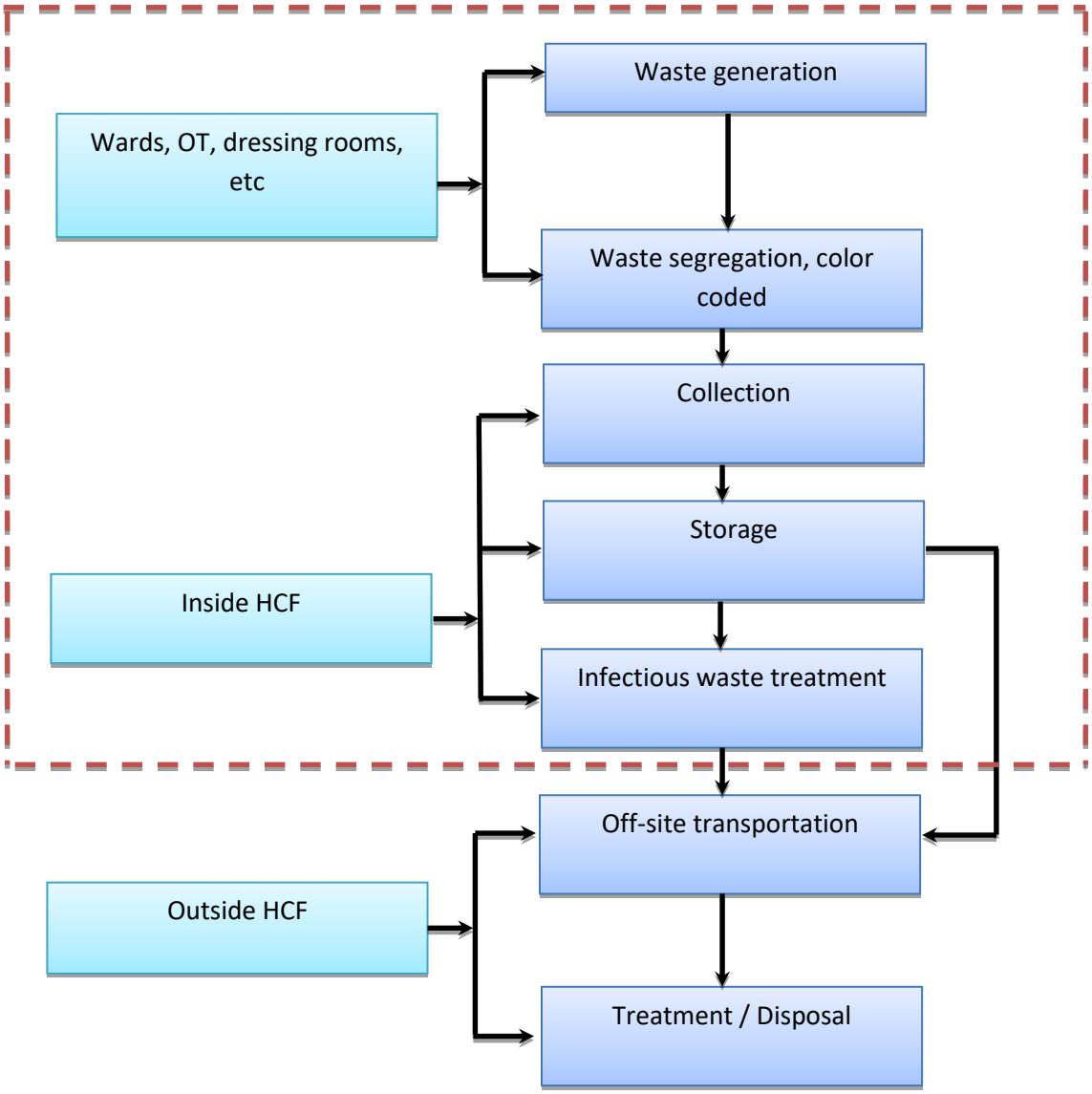
Table 2.3: Sources of health care waste

Major sources of health care waste	Minor sources of health care waste
Public/private Hospitals **Health Centres** **Private clinics** **Transfusion Centers** **Medical research centers**	Dental clinics Acupuncture clinics Pathology laboratories Alternative medical practices Veterinary Home health care Long term care facilities Psychiatric facilities Activities involving intravenous or subcutaneous interventions pharmacies Parlors (eg cosmetic ear-piercing) Illicit drug users and needle exchanges Ambulance services

Chapter 3: HEALTH CARE WASTE MANAGEMENT

3.1 Steps involved in health care waste management

Safe and effective management of HCW involves main key steps, including waste minimization, identification of relevant categories, segregation in designated colour coded bins/containers, collection, storage, transportation, treatment and final disposal. The following steps should be followed in all HCF's.



3.1.1 Health Care Waste segregation

- HCW segregation is the most important step to successful management of waste in a HCF, which includes the process of separating different types of wastes at the point of generation and keeping them isolated from each other.
- Wastes should be segregated at the point of generation in all HCF's and should be the responsibility of the person that produces each waste item.
- Hazardous and non-hazardous wastes should NOT be mixed at the point of generation.
- HCF management should ensure there is a suitable segregation, collection, storage and transport system established, and that all staff adheres to the correct procedures.
- All HCF's should adopt the CORRECT color coding as listed in Table 3.1.
- Separate containers and bags should be made available in all areas of the HCF depending on the wastes generated.
- To improve segregation, up-to-date waste audit data can be used to assess the volume and type of waste containers required

3.1.1 Colour coding

- Colour coding makes it easier for medical staff and hospital workers to put waste items into the correct container, and maintain segregation at the point of generation, transportation, storage, treatment and disposal. It also provides a visual indication of the potential risks posed by HCW.
- Colour coding of HCW is listed in table 3.1 should be strictly followed in all HCF's.
- Sharp waste containers should be puncture proof and leak proof. HCF's can decide to use one colour code (white or yellow or red) for sharp waste in all areas/departments. In case a HCF decides to change the colour code due to any reason, reorientation of all staffs should be ensured before bringing the changes.

Table 3.1: Categories, colour coding, treatment and disposal options for different types of waste

Type of waste	Colour coding	Label / symbol	Onsite Treatment (Detials – chapter 4)	Offsite treatment/Disposal
INFECTIOUS WASTE				
Non-sharp waste		BIOHAZARD	Autoclave	Contractor to collect and dispose as general waste
Highly infectious non-sharp waste		BIOHAZARD Label as "Highly infectious"	Autoclave	Contractor to collect and dispose as general waste
Sharp waste	White or Red or Yellow 	BIOHAZARD	Autoclave	Contractor to collect transport to Reginal waste management facility
Anatomical waste (body parts, limbs, placenta, organ, products of conception.		BIOHAZARD	No onsite treatment	Only for burial in a cemetery / designated place in island
PATHOLOGICAL WASTE				
Blood and body fluids - Small quantity	None	BIOHAZARD	Decontaminate and discard in drain	None

Body tissues, other waste from surgery and autopsies			Autoclave	Contractor to collect and dispose in island waste management site
Blood and body fluids - Large quantity			Autoclave	Contractor to collect and dispose in island waste management site
PHARMACEUTICAL WASTE				
All types of pharmaceutical waste	BROWN or PINK (HFC to chose one colour) 		No onsite treatment	Contractor to collect and store in island waste site Treat and dispose according to MFDA standards.
Used vials	BROWN or PINK (HFC to chose one colour) 		No onsite treatment	Contractor to collect and store in island waste site Treat and dispose according to MFDA standards.
Cytotoxic non-sharp waste (Items contaminate with blood and body fluids, etc)			No onsite treatment	Contractor to collect and transport to designated Regional facility Treat and dispose according to MFDA

				standards.
used Vials (Cytotoxic)			No onsite treatment	Contractor to collect and transport to designated Regional facility Treat and dispose according to MFDA standards.
Cytotoxic sharp waste			No onsite treatment	Contractor to collect and transport to designated Regional facility
Chemical Waste				
Chemical waste containing used bottles/containers		 Label as "CHEMICAL WASTE"	No onsite treatment	Contractor to collect and dispose according to National standards
Pressurized containers	None	 Label as "PRESSURIZED CONTAINERS"	No onsite treatment	Contractor to collect and dispose according to National standards

Radioactive Waste	None		Decay (short-life radioactive waste) in the designated storage facility (locked/labelled)	Decay in the Regional storage facility (locked/labelled hazardous)
Other waste				
E- waste	None	 Labell as "E – waste"	No onsite treatment	Contractor to collect and dispose according to National standards
Battery	None	 Labell as "Battery"	No onsite treatment	`
GENERAL WASTE				
Food waste		Label as food waste	No onsite treatment	Contractor to collect and dispose according to National standards
Nappies Sanitary napkins		Label as 'Nappies/Sanitary napkins"	No onsite treatment	Contractor to collect and dispose according to National standards

Recyclable waste (glass bottles, cans etc)		Label as recyclable waste	No onsite treatment	Contractor to collect and dispose according to National standards

3.1.2 Waste containers/bins and bags

- All HCF's should ensure the continuous availability of containers/bins and bags according to the colour coding.
- Containers/bins used for HCW collection should be:
    - strong and leak proof.
    - lined with a strong leak proof plastic bag.
    - foot operating with well-fitting lids.
- Both the container and the bag should be of the same color for the waste type
- Contaminated and uncontaminated sharps should be collected in a puncture-proof, leak proof **"SHARP CONTAINER".**
- Cytotoxic waste should be collected in a strong leak proof, puncture proof container, clearly labeled as '**cytotoxic waste'**
- Make sure the containers are large enough for the quantity of waste generated at that location during the period between collections.
- The recommended thickness of bags for infectious waste is not less than 70 µm (ISO 7765 2004) and has to be capable of **autoclaving**. Plastic bags used for all types should be **chlorine-free**.

3.1.3 Packaging and handling

- Health care workers and other clinical staffs should ensure waste bags and sharp containers are securely sealed or closed when 3/4th full and should not be reopened.
- Plastic bags should be tied or sealed, and never stapled.
- Double bags should be used for infectious wastes from high risk areas such as infectious disease and isolation wards and for wastes such as placenta and organs and body parts
- All hazardous health care waste bags should be handled by the neck only.
- General waste should be handled separately from infectious and other hazardous health care waste.
- Replacement of colour coded bags and containers should be readily available at each waste collection area and replaced immediately when full.

3.1.4 Collection

- Health care waste should be collected daily from all the areas of the hospital at a fixed time interval. Depending on the amount of waste generated in area(s) there can be multiple collections during the day.
- General waste should not be collected at the same time as infectious waste and other hazardous wastes to avoid mixing.
- Waste handlers should wear proper PPE's when collecting and handling waste.

3.1.5 Labeling

- All types of waste bags/containers should be clearly labeled with the international hazard symbol for hazardous health care waste as listed in Table 4
- The waste containers/bags should be properly labeled with information of the waste generator including the facility name and address, date, type of waste and contact number.
- The following ways can be used for labeling;
    - Writing information on the bag or container;
    - Using pre-printed tape;

- Containers and bags for infectious waste should be marked with international infectious symbol and should not be placed in public areas.
- **DO NOT** remove bag from the bin unless it is closed off and labeled correctly.

3.1.6 Storage of health care waste

a. Temporary storage

- If need arises, wastes can be stored in the Dirty Utility room on a temporary basis.
- HCW generated in procedure areas such as operation theater and in-patient care areas should be removed immediately and not stored on a temporary basis.

b. Central storage facility

- All HCF's should allocate a designated area for health care waste storage and treatment (only infectious waste) in the HCF premises, till the waste is transported to a designated disposal facility in the island.
- The storage facility should be located away from patient and visiting areas.
- The size of this facility should be based on the quantity and different types of waste (infectious waste (pharmaceutical, cytotoxic and chemical waste, etc.,) generated.
- An area should be allocated to store the treated and clean waste
- The storage facility should have enough space to store chemical, pharmaceutical and other hazardous waste till the wastes are transported to the island waste management site.
- HCF's with oncology treatment services should have a separate storage room/area for cytotoxic waste
- Appropriate signage with hazard signs should be posted in the storage areas
- The general requirements of the storage area are detailed in Annex 1

3.1.7 Record Keeping

- All HCF's should maintain daily records of waste generated (format in Annex 2) in category wise quantity (in kg/day)

- A weighing machine should be made available in the central storage facility in all HCF's.
- Monthly HCW report should be submitted to Health Protection Agency (HPA) by all HCF's before 15th of each month (format in Annex 2).
- Records of waste related prick injuries, spills and accidents should be maintained and informed to the waste officer or designated focal points.

3.1.8 Onsite - transportation of health care waste

3.1.8.1 Transport trolleys

- Trolleys used to transport health care waste should be dedicated for the purpose of transportation of waste and should meet the following criteria:
  - appropriate size according to the volumes of waste generated
  - easy to push and pull (with wheels) and easy to load and unload
  - Lidded to avoid spillage
  - color coded, labeled and dedicated to a particular waste type
  - with 5% active chlorine solution
  - Easy to clean, no sharp edges that might damage waste bags or containers
- Spare trolleys should be made available in case of breakdown and maintenance.
- The trolleys should be cleaned and disinfected daily or cleaned immediately when necessary.

3.1.8.2 Routing

- Health care waste should be transported through a **specific route** within HCF's from wards/areas/departments, to prevent exposure to patients, workers and visitors.
- When planning waste transportation route, the following should be considered;
  - wastes are transported through specific routes and not through high risk areas and areas having high traffic of patients and visitors
  - waste collection has easy access to avoid spillage and scattering of waste

- central waste storage facility can be easily accessed through the route

3.1.9 Off-site transportation of health care waste

- Off-site transportation is the transfer of health care waste from a HCF to a designated waste management facility in the island, by an authorized/licensed waste management contractor.
- The health care waste generator (HCF/institutions) is responsible for safe packaging and labeling the waste that has to be transported out of the facility for treatment and disposal.
- To ensure safe transport and monitoring of health care waste generation to disposal, it is recommended to establish tracking system or barcode system.
- The contractor should ensure to designate trained staff for handling health care waste and should comply with the national waste management regulations and standards.
- A designated vehicle should be used by the contractor to transport hazardous health care waste and should fulfill the requirements listed in Annex 4.

3.2 Waste Minimization

- Waste minimization is a practice that can be implemented by all HCF's to reduce the wastes generated by implementing the processes such as reduce, reuse, and recycling.
  1. **Reduce** includes practicing green procurement and replacement of equipment and consumables with environment friendly options, that generates less waste.
  2. **Reuse** can minimize the volume of waste and includes selecting or purchasing items that are reusable rather than using disposable products, **wherever possible**. Reuse **SHOULD NOT** be encouraged for the items that cannot be disinfected and can pose risks of cross-infection.
  3. The non-hazardous portion of health care waste items including organics, plastics, paper, glass and metal generated in health care facilities can be easily **recycled** to reduce the waste generation.

- To achieve waste reduction or minimization, all employees should be trained and waste minimization practice should be implemented in all the areas of HCF.
- Health care manager can also take measures in implementing environmentally preferable purchasing (EPP) or sustainable procurement in the HCF. The following are some of the examples of EPP:
    - Reducing the purchase of products containing PVC and other hazardous materials and purchasing safer alternatives.
    - Reduce excessive packaging and purchasing plastics that can be easily recycled.

CHAPTER 4: HEALTH CARE WASTE TREATMENT AND DISPOSAL

The treatment and disposal methods for different types of wastes generated as listed in Table 4 should be followed by All HCF's, in order to reduce the potential hazards posed by health care waste.

4.1 General waste disposal

Management of general (non-hazardous) waste should comply with the National waste management regulations and standards. General wastes including recyclable waste should be transported out of the HCF by the authorized/licensed contractor and disposed in a designated waste management site in the island.

4.2 Infectious waste treatment and disposal

- All HCF's should use NON-BURN technology for the treatment of the following infectious and sharp waste:
    - Non-sharp waste
    - Highly infectious waste
    - Sharp waste
    - Pathological waste (body tissues other wastes from surgeries and large quantity of blood and body fluids)
- The treatment options listed in table 3.1 should be followed for infectious waste categories listed above.
- The following should be considered when selecting the treatment technology
    1. Treatment efficiency
    2. Quantity of waste /capacity of the system
    3. Infrastructure and space requirements (investment & operational costs)
    4. Volume and mass reduction
    5. Training requirements for operation of the method (availability of skills)

6. Operation and maintenance considerations
7. National Regulatory requirements

- Methods listed below can be used in a HCF, for the decontamination of infectious and sharp waste:

1.1 Waste Autoclave (with or without shredder)

- Autoclaving is the most common type of steam treatment used and is capable of treating infectious wastes including sharps, cultures/stocks, waste materials contaminated with blood and fluids (gauze, bandages, drapes, gowns, and laboratory waste (excluding chemical waste)
- Autoclaves come in with or without an integrated shredder and with a wide range of sizes.
- Autoclaves are also categorized according to the method of air removal. The 3 common types include[1]:
  1. Gravity-displacement autoclaved
  2. Pre-vacuum or high vacuum autoclaves
  3. Pressure pulse autoclaves
- Procedures in Annex 5 should be followed when autoclaving infectious waste

1.2 Microwave

- Microwaving technology heats (temp 95 to 100^0C) the water contained in the waste by microwave energy and destroys the microorganisms by moist heat.

- It is recommended to shred the decontaminated infectious waste before sending to an offsite waste management facility to prevent the reuse.
- In laboratories and other patient treatment areas, **small quantity of blood and body fluids** should be decontaminated before disposing into the drain. To decontaminate blood and body fluids, use freshly prepared 1-part bleach to 9-parts liquid waste, keep for 30 minutes before pouring it down the drain.[3]

- Anatomical waste including (body parts, limbs, placenta, organ, products of conception) should ONLY be buried in a cemetery or in a designated place outside the HCF by the island council.

4.3 Pharmaceutical waste treatment and disposal

- Hazardous pharmaceutical waste should NOT be autoclaved or discharged into the ground or sewerage system.
- As much as possible minimization of pharmaceutical waste should be practiced by using good inventory strategies such as;
    - Purchasing routinely administered dosages of drugs
    - Using the existing stock before the new supply
    - Using similar good management practices
- Pharmaceutical waste should be properly labelled with the hazard symbol, and can be returned to manufacturer OR transported out of the HCF to an island waste management site.
- Management of pharmaceutical waste should comply with the National pharmaceutical waste management standards.

4.4 Cytotoxic waste treatment and disposal

- Treatment and Disposal of cytotoxic waste should comply with the National waste management regulations and standards.
- This type of waste should NOT be discharged into the ground or sewerage system.
- Cytotoxic waste should be labeled with the hazard symbol before and can be returned to manufacturer OR transported out of the HCF to a Regional waste management facility, treated and disposed as per the National pharmaceutical waste management standards.

4.5 Chemical waste

- Where possible HCF's should practice minimization of chemical waste. Minimization options include:
    - Substituting with less toxic and environment friendly chemicals.
    - Ensuring good inventory practices.
    - Using similar good management practices.
- Chemical waste should NOT be disposed on the premises of health-care facilities or discharged into the ground or sewerage system.
- Disposal and transport of chemical waste should comply with National waste management regulations and standards.
- Mercury wastes stored in the health care facility should be properly labeled and transported to a designated Regional waste management facility.

4.6 Radioactive waste

- All HCF's should notify Ministry of Health (MoH), and relevant authorities and waste management contractors when generating radioactive waste.
- Disposal and transport of radioactive waste should comply with National waste management regulations and standards.
- Radioactive waste SHOULD NOT be mixed with any types of waste
- Where possible replace long-lived radionuclides with non-radioactive substitutes or shorter half-life radionuclides.
- The following are the 3 disposal methods possible for low-level radioactive waste:[1]
    - "decay in storage", which is the safe storage of waste until its radiation levels are indistinguishable from background radiation; a general rule is to store the waste for at least 10 times the half-life of the longest-lived radionuclide in the waste[1].
    - long-term storage at a designated, authorized radioactive waste disposal site[1].
    - return to supplier

- An authorized/licensed contractor should transport and store radioactive waste in a designated facility. The contractor should have designated trained personals and should comply with the national waste management regulations and standards.
- All HCF's should have designated trained staff for handling hazardous radioactive waste and should comply with the national waste management regulations and standards.

CHAPTER 5: HEALTH AND SAFETY PRACTICES

- All HCF's should ensure the occupational safety of health care professionals and all workers handling waste, to prevent and control exposures to them.
- The following health and safety measures should be ensured in all HCF's[1].
  - Develop a standardized set of management rules and operating procedures for health-care waste;
  - Inform and train waste workers so that they perform their duties properly and safely;
  - Involve waste workers in the identification of hazards and recommendations for prevention and control;
  - Provide PPE and clothing for personal protection
  - Establish an occupational health program that includes information, training and medical measures when necessary, such as immunization, post-exposure prophylactic treatment and regular medical surveillance.
  - Establish a regular monitoring mechanism

5.1 Training

- Training and capacity building of health-care staff are important in the efforts to prevent occupational and public health exposures to the hazards associated with health-care waste. It is the HCF manager's role to ensure.
- There should be a trained focal point in each HCF to facilitate HCWM training to all levels of staff based on the National HCWM training manual.
- The HCF Management should ensure regular training including refresher trainings to all waste handlers and awareness programs to all staff including.
- HCW management training should also be included in the orientation program conducted for new staff.

- If any changes are brought to the procedures of waste handling in a HCF, all staffs should be reoriented and well informed.
- It is the responsibility of the contractor to ensure the designated drivers and waste handling staff are trained and regular refresher trainings are conducted to prevent exposures related to health care waste.
- HCF's should ensure to keep the records of trainings (refresher, orientation, etc) and educational and awareness programs related to HCWM

5.2 Hand hygiene

- Hand hygiene including hand washing and hand disinfection, should be seen as the primary preventive measure that is the responsibility of all involved in handling, disposal and treatment of HCW.1
- All HCF's should ensure the continuous availability and access to soap and water and hand rubs for hand hygiene.
- Hand hygiene procedures should be included in the training and awareness sessions and hygiene posters provided to all areas in HCF.
- All staff working in HCF's should ensure to follow the hand hygiene procedures in Annex 6 and Annex 7

5.3 Spill Management

- All HCF's should have detailed procedures for the management of chemicals, body fluids and mercury spillage.
- Spill management kits should be made available with necessary items for different types of spillage. Table 5 provides a typical list of required items.[1]
- In case of skin and eye contact with hazardous substances, there should be immediate decontamination. An exposed person should be removed from the area of the incident for decontamination, generally with copious amounts of water. Special attention should be paid to the eyes and any open wounds. In case of eye contact with corrosive chemicals, the eyes should be irrigated continuously with

clean water for 10–30 minutes; the entire face should be washed in a basin, with the eyes being continuously opened and closed[1].

Table 5: Example of a list of items for spillage[1].

Action	**Tools or items**
Approaching the spillage	Protective equipment (to secure the area)
Containing the spillage	Absorbent material (e.g. absorbent paper, towels, gauze pads)
Neutralizing or disinfecting the spillage (if necessary)	For infectious material: disinfectant For acids: sodium carbonate, calcium carbonate or other base For bases: citric acid powder or other acid For cytotoxic material: special chemical degradation substances
Collecting the spillage	For liquids: absorbent paper, gauze pads, wood shavings, calcium bentonite, diatomaceous earth For solids: forceps, broom, dustpan or shovel For mercury: mercury sponge or vacuum pump
Organizing containment for disposal	Plastic bag infectious (yellow)
Decontaminating or disinfecting the area	For infectious material: disinfectant For hazardous chemicals: suitable solvent or water
Documenting the spillage	Report of incident to the superior

5.4 Reporting accidents and incidents

- All the staff involved in HCWM waste-management staff should be trained in emergency response and awareness created on the correct procedures for prompt reporting1.
- Accidents or incidents, including near misses, spillages, damaged containers, inappropriate segregation and any incidents involving sharps, should be reported to the designated waste-management officer (if waste is involved) or to another designated person1.
- The cause of the accident or incident should be investigated by the waste-management officer (in case of waste) or other responsible officer, who should also take action to prevent recurrence1.
- The records of the investigation and subsequent remedial measures should be kept in all HCF's1.

5.5 Personal Protective Equipment's

- The following PPE's should be provided to the waste handlers by the HCF's. The waste handlers should ensure the use of PPE's when handling waste.

heavy duty gloves for attendant's/waste collecto

1. Heavy duty gloves
2. Gum Boots for waste handlers
3. Face Mask
4. Head Cap
5. Apron (splash proof)
6. Goggles (if needed)
7. Lead Apron (for radioactive waste)

CHAPTER 6: HEALTH CARE WASTE MANAGEMENT PLANNING

6.1 Planning and Organization

- Appropriate and efficient HCWM practices depends largely on the commitment from the management of the HCF's and requires and financial support with the involvement of dedicated, trained and skilled staff[4].
- The organizational structure and all services (major/minor) of HCF should be made responsible for the safe management of HCW[4].

6.2 Roles of Administration

- Form a Health Care Waste Management Committee (HCWMC) and designated Health Care Waste Management Officer (HCWMO) to coordinate and supervise the Health Care Waste Management Plan (HCWMP) **OR**

  Reform the existing Infection Prevention Control Committee with a designated Health Care Waste Management Officer (HCWMO) to coordinate and supervise the HCWMP.

  - HCWMC, can include the following personals, but not limited to:
    1. HCF Manager
    2. Department heads
    3. Nursing in charge
    4. In charge of housekeeping
    5. Waste Management Officer
  - The roles and responsibilities of HCWMC should be as follows, but not limited to:
    1. Develop the Terms of Reference of HCWMC
    2. Carry out health care waste assessments
    3. Develop the HCWMP based on the national regulations and standards
       - Ensure sufficient annual budget allocation for HCWM
       - Ensure implementation of the plan

- Review and update the plan annually and share the findings with all staff of HCF
- Ensure continued training and orientation of all staff

- Ensure the development, implementation and updating of the HCWMP
- Establish a coordination mechanism with relevant organizations including the designated/licensed contractor.

6.3 Health care waste management plan

- All HCF's should develop a Health Care Waste Management Plan (HCWMP) with clear identification of responsibilities and the plan should be comprehensive and up to date.
- When developing the plan, existing and future needs of the HCF should be taken into consideration
- Detailed baseline assessment of HCWM should be carried out including the following but not limited to:
    - areas of waste generation
    - types and quantity of waste generated
    - categorization of waste
    - segregation of waste
    - Process of waste collection, storage and transportation
    - Procedures of waste treatment and disposal
    - waste minimization practices
    - cost effectiveness of current practices
    - personal safety of waste handlers
    - trained personnel's
- Effective implementation of the plan should be ensured comprehensive training and orientation should be given to all staff in the HCF including roles of each individual.

- The management should also ensure to orient and educate the authorized/licensed contractor who is responsible to transport HCW's generated in the hospital to the designated island waste management site.

6.4 Monitoring and Evaluation

- All HCF's should establish a proper monitoring mechanism for all the activities related to HCWM.
- Regular monitoring and evaluation of the implementation of HCWMP should be carried out by all HCF's to identify the issues and gaps, that require immediate action(s). All staff should be informed, reoriented and reinforced on good practices.
- Compliance monitoring and evaluation should be conducted annually at atoll level and national level

References:

1. World Health Organization (2014), Safe management of wastes from health-care activities: Second edition
2. Ministry of Health (2013) National Health Care Waste Management Guideline Kingdom of Swaziland
3. Canadian Biosafety Handbook, Second Edition, https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/handbook-second-edition/chapter-16-20.html
4. Ministry of Health and Population (2014), Health Care Waste Management Guideline, Nepal
5. ICMWM, National Guideline on Infection Control and Medical Waste Management, Bhutan
6. Ministry of Health and Welfare (2016), Guidelines for Management of Healthcare Waste as per Biomedical Waste Management Rules, India
7. Department of Health (2020) Health Care Waste Management Manual 4th Edition, Philippines.
8. Waste UC San Diego, Autoclave: Biohazardous https://blink.ucsd.edu

Annex 1: Central storage facility (inside HCF) requirement

- The size of the central storage facility should be decided based on the level and types of HCW's generated in a HCF.
- The following are the general recommendations for the storage facilities for HCW[1].
    - have an impermeable, hard-standing floor with good drainage and the floor should be easy to clean and disinfect;
    - keep clean area for general waste and separate areas for infectious and other hazardous waste (chemical, pharmaceutical and radioactive);
    - have a water supply for cleaning purposes;
    - have easy access for staff in charge of handling the waste;
    - be lockable to prevent access by unauthorized persons;
    - have easy access for waste-collection vehicles;
    - have protection from the sun;
    - be inaccessible to animals, insects and birds;
    - have good lighting and at least passive ventilation;
    - not be situated in the proximity of fresh food stores and food preparation areas;
    - have a supply of cleaning equipment, protective clothing and waste bags or containers located conveniently close to the storage area;
    - have a washing basin with running tap water and soap that is readily available for the staff;
    - be cleaned regularly;
    - have spillage containment equipment;
    - be appropriate to the volumes of waste generated from each health-care facility.
- When constructing new HCF's, based on the level and services the design **SHOULD** include appropriate waste storage areas for different types of wastes (Refer to WHO document for further information).

- Hospitals providing cancer care services should have a designated storage area for radioactive waste[8]. The following should be enured;
    - Post the area and label each collection container with a RADIOACTIVE warning symbo[8]l.
    - Use appropriate shielding where applicable[8].
    - Give special shielding consideration to high-activity or high-energy isotopes such as orthophosphate[8].
    - Keep containers closed, except when material is being added. Make sure the container and bag exteriors are free of contamination[8].
- Storage areas should be totally enclosed and separate from supply rooms or food preparation areas.
- Storage facilities should be labelled in accordance with the hazard level of the stored waste. Figures 7.8 and 7.9 show typical signs advising the hazard posed by waste.

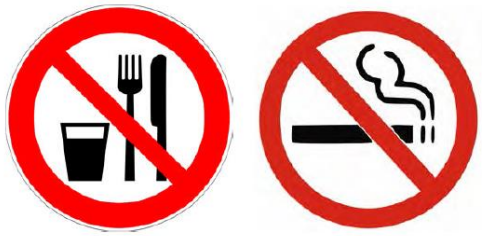
No entry for unauthorized persons for all storage areas

Biohazard sign for infectious and sharps waste

Toxic sign for chemical and hazardous pharmaceutical waste

Figure 7.8 Example labels outside the storage facility

Figure 7.9 illustrates the signs that should be displayed inside the storage facilities.



No eating or drinking

No smoking

Figure 7.9 Example labels inside the storage facility

Annex 2: Daily record form for HCW

Name of the HCF:

#	Date / time	Waste categories quantity in KG's						Location of waste generation	Physical form (Gas, liquids, etc	Person who weighed	Notes
		Yellow	Red	Purple	Brown	Black	Green				

Annex 3: Monthly Reporting Form for HCW

Name of the HCF:
Date of reporting:
Month:
Report developed by:

Types of waste	Colour code used	Amount of waste generated in KG's	Method of treatment	Method of transport	Method of Disposal
General waste					
Recyclable waste					
Infectious waste					
Sharp					
pathological waste					
Anatomical waste					
Pharmaceutical waste					
Chemical waste					
Pressurized containers					
Radioactive waste					

Note: Report should be submitted to HPA before 15th of each month

Annex 4: Transport vehicle requirements

- A designated vehicle should be used by the contractor to transport hazardous health care waste and should fulfill the requirements listed below.
    - The vehicle should have fully enclosed compartment to load wastes and should be separate from the driver's compartment to prevent contacts from waste in the events of collision/accident[7].
    - The internal surface of the vehicle body should be smooth and all corners/angles rounded for easy cleaning
    - The walls should be of a washable material, and floors shall be metal surfaced to ensure effective cleaning and disinfection.
    - The floor of the storage compartment shall be sealed and leak proof.
    - The vehicle shall have a form of collection basin, below the floor level, to contain leakage from the waste.
    - There should be a suitable system for securing the load during transport.
    - The vehicle should be marked with the address of the waste transporter with emergency contact number, hazard symbols (higher resolution images) according to the type of waste that is being transported

- The vehicle should be roadworthy and labeled to indicate its load
- The following items should be carried in the vehicle;
    1. suitable protective clothing
    2. empty plastic bags
    3. disinfectants and cleaning equipment's/tools
    4. kits for different types of spills as listed in Table 5
    5. first aid kits
- The waste loading compartment should be kept locked at all times, except when loading and unloading, and should be properly maintained.
- Health care waste should NOT be compacted that could cause waste bags or containers to rupture.
- The authorized/licensed contractor should maintain a completed consignment note. The consignment note should include, but not limited to the following information:
    1. Name, address, telephone number, accreditation/authorization number of Contractor
    2. Name, address and telephone number of the generator
    3. Type and quantity of was transported
    4. Waste collection date from the facility
    5. Waste receivable date to the disposal and treatment facility

- The contractor and the waste generator should maintain a copy of the consignment note.
- Accidents / incidents should be reported and documented by the contractor and the records should be kept.
- Seek medical attention if exposed to hazardous material during the operation.
- Vaccination against tetanus and hepatitis B is recommended for the HCW handlers.
- Record of details of training and vaccination should be kept by the contractor.
- The waste loading compartment of the vehicle, trolleys/containers/bins should be properly cleaned and disinfected by using proper cleaning and disinfection agents daily or at the end of each transfer or in the event of spillage.

Annex 5: Procedure for Waste Autoclave

All HCF's should use a dedicated waste autoclave (steam sterilizer) to decontaminate and treat infectious wastes (ONLY)

5.1 Procedure:

- Ensure to follow the manufacturers guidelines when handling the waste autoclave.
- The following procedures should be followed when autoclaving infectious waste:
  - **Waste collection:** Infectious waste bags are placed in a metal cart or bin. The cart or bin should be lined with a plastic liner to prevent waste from sticking to the sides of the container[1].
  - **Pre-heating (for autoclaves with steam jackets):** Steam is introduced into the outside jacket of the autoclave[1].
  - **Waste loading:** The metal cart or bin is loaded into the autoclave chamber. With every load, a colour-changing indicator is attached to the outer surface of the waste bag in the middle of the waste load to monitor treatment. The entry (or charging) door is closed, sealing the chamber[1].
  - **Air evacuation:** Air is removed through gravity displacement, pre-vacuuming or pulse vacuuming[1].
  - **Steam treatment:** Steam is introduced into the chamber until the required pressure or temperature is reached. Additional steam is automatically fed into the chamber to maintain the temperature and pressure for a set time period. Pressure pulsing autoclaves vary the pressure according to a set process cycle[1].
  - **Steam discharge:** Steam is vented from the chamber, usually through a condenser, to reduce the pressure and temperature. In some systems, a post-vacuum cycle is used to remove residual steam and to dry the waste[1].
  - **Unloading:** Usually, additional time is provided to allow the waste to cool down further, after which the treated waste is removed and the indicator strip is

checked. The process is repeated if the colour change on the indicator shows that the treatment cycle was insufficient[1].

- **Documentation:** A written log is maintained to record the date, time and operator name; type and approximate amount of waste treated; and post-treatment confirmation results from any automated equipment recording or temperature–pressure monitoring indicator, such as the indicator strip[1].
- **Mechanical treatment:** If desired, the treated waste may be fed into a shredder or compactor before disposal in a landfill[1].

5.2 Parameters for different types of autoclaves

- Medical Wastes should not be considered treated unless the operational indicators in the table is reached during the autoclaving process[5].
- In case, any operational parameter is not reached, the entire load of medical waste should be autoclaved again until the proper requirements are achieved[5].
- DO NOT overload the autoclave; there should be at least 2 inches of space around each waste bag on all sides to allow access to surfaces by the steam. No other materials should be autoclaved in the same load[5].

Table 6: Operational parameters for different types of autoclaves[5]

Types of autoclave	Temperature (^{0}C)	Pressure (pounds/inch^2)	Time (Min)
Gravity Flow	121	15	60
	135	31	45
	149	52	30
Vacuum Autoclave (*at least one prevacum pulse to purge the autoclave of all air)	121	15	45
	135	31	30

5.3 Recording of operational parameters

Each autoclave should have graphic or computer recording devices which will automatically and continuously monitor and record dates, time of day, load identification number and operating parameters throughout the entire length of the autoclave cycle[6].

5.4 Validation test for autoclave

Routine test

Chemical indicator strips that changes colour on reaching a specific temperature should be used at every process/cycle to verify that the desired temperature has been achieved. It is desirable to use more than one paper strip over the waste package at different locations to ensure efficacy of autoclaving[4].

Spore testing

Bacillus stearothermophilus spores are used as biological indicator using vials or spore strips, with minimum 10000 spores per ml. This should be carried out at least once in every month by the Microbiology laboratory[5].

Precaution

- Always wear thermal protection gloves when handling items that have recently been autoclaved[5].
- Use caution when opening the door of the autoclave after a run, as steam will be released[5].

Wastes that should NOT be autoclaved

- Cytotoxic/chemotherapy waste
- Toxic and volatile chemicals
- Radioisotopes

- Hazardous waste that can be vaporized and disseminated with heat.
- Plastics that can produce toxic gas including Polyethylene, High-density polyethylene, Polyvinyl chloride and Polystyrene[8].

Annex 6: Hand rub procedure

Annex 7: Hand wash procedure

How to Handwash?

WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

Duration of the entire procedure: 40-60 seconds

World Health Organization | Patient Safety — A World Alliance for Safer Health Care | SAVE LIVES Clean Your Hands

May 2009