

MODULE C

One Day Training on Health Care Waste Management (HCWM)

(For Support Staff)

Submitted to:

Promoting Green Recovery Project (PGRP)
United Nations Development Programme (UNDP)
Nepal

Submitted by:



Eco Concern Pvt. Ltd
Khumaltar, Lalitpur, Nepal
Email: info@ecoconcern.com.np
Contact number: +977-5151358

Normative References

This Training Module has been produced for delivery of one day training (on-site) for the health care waste management for Medical Personnel (Doctors, Nurses, Paramedics). The following mentioned documents have been used as references for the preparation of this document.

- Master Training of Trainers (MToT) training package on Environmental Health, Health Care Waste Management and WASH Developed by NHTC, Teku.
- National Healthcare Waste Management Standards and operating Procedures 2020, MoHP (2020)
- National Standards on WASH for Healthcare Institutions, MoHP (2078)

Name of the Training: 1 Day Training on Health Care Waste Management (HCWM)
(For Support Staff)

Objective of the Training

- Understand the concept of HCWM
- To gain an overall understanding on Health care waste management including types of waste generation, classification, segregation, storage, transportation and treatment methods.
- Understand the concept of Occupational Safety and Health (OSH) and the risks they are exposed
- understand the work environment through practical session activities
- understand the work environment, its surroundings and the risks they are exposed to through Facility walk through session

Target Participants:

The target participants of the training are support Staffs involved with health care waste handling such as waste handlers, cleaners, and laundry staff

List of Acronyms

EH	Environmental Health
HCF	Health Care Facility
HCW	Health Care Waste Management
HCWM	Health Care Waste Management
ICU	Intensive Care Unit
NHTC	National Health Training Centre
OPEP	Occupational Post-Exposure Prophylaxis
OSH	Occupational Safety and Health
PPE	Personal Protective Equipment
SOP	Standard Operating Procedure
SWM	Solid Waste Management

Contents

Objective of the Training	II
Target Participants:.....	II
List of Acronyms.....	III
Module Session Plan	1
SESSION 1: INTRODUCTION OF HCWM	2
1.1 Situation of Health Care Waste Management (HCWM) in Nepal.....	2
1.2 Importance of Health Care Waste Management	2
1.3 Risk of HCW for Human Beings.....	2
1.4 Regulations, Policy, Existing National Guidelines and Directives on HCWM	3
1.5 Principle for Healthcare Waste Management	3
SESSION 2: HEALTH CARE WASTE MANAGEMENT	5
2.1 Definition and Sources of Health Care Waste	5
2.2 Classification of Health Care waste	6
<i>Activity 1: Types of Waste</i>	7
2.3 Waste Segregation	8
SESSION 3: HEALTHCARE WASTE COLLECTION, TRANSPORTATION, WASTE STORAGE AND TREATMENT.....	10
3.1 Health Care Waste Collection.....	10
3.2 On-site transportation of HC Waste	11
3.3 Offsite transportation of HC Waste.....	12
3.4 Storage of HCW	13
<i>Activity 2: Waste Storage</i>	13
3.5 Waste Treatment Technologies	14
3.6 Options for Treatment of HCW	15
<i>Activity 3: Segregation of HCW</i>	16
SESSION 4: OCCUPATIONAL SAFETY AND HEALTH	17
4.1 Occupational Health Impact	17
4.2 Personal hygiene and hand hygiene	17
4.3 Safety of Healthcare workers.....	18
4.4 Occupational Post-Exposure Prophylaxis (OPEP).....	21
4.5 Emergency Response in case of Leakage.....	21
4.6 Infection Prevention and Control Measures.....	22
4.7 Role and responsibility in infection prevention and control	22
SESSION 5: FACILITY WALKTHROUGH AND DISCUSSION	24

List of Figures

Figure 1: Waste Collection Bins, Bucket with Medication trolley and stand	10
Figure 2 : Trolleys for Onsite Transportation of HCW	11
Figure 3: Transportation trolley for infectious waste (Photo Source: Eco Concern Pvt. Ltd)	12
Figure 4 : Waste Storage area with for different category of wastes (Photo Source: Eco Concern Pvt. Ltd)	13
Figure 5 : Steps of Hand Washing (Source: WHO Guideline on handwashing).....	18
Figure 6: Waste Handlers with PPE while handling the HCW (source :)	19

List of Tables

Table 1: Classification of HCW	6
Table 2: Recommended color-codes for the container, labelling and international signs for HCW	9
Table 3: Techniques currently available for the treatment and disposal of HCW	14
Table 4: Treatment technologies for treating various health care wastes	15

Module Session Plan

This Module prepared for the support staff has been divided into 4 sessions

TOPIC	6 Hrs 30 Mins
SESSION 1 INTRODUCTION OF HCWM	45 Mins
Situation of Health Care Waste Management in Nepal	
Importance of Health Care Waste Management	
Risk of HCW for Human beings	
Regulations, Policy, Existing National Guidelines and Directives on HCW	
Principle of Healthcare Waste Management	
SESSION 2 HEALTH CARE WASTE	1 Hr 45 Mins
Definition and Sources of Health Care Waste	
Classification of Health Care waste	
Activity 1 - Types of Waste (1 Hr)	
Waste Segregation	
SESSION 3 HEALTHCARE WASTE COLLECTION, TRANSPORTATION, WASTE STORAGE AND TREATMENT	2 Hr 15 Mins
HC Waste Collection	
On-site Transportation of HC Waste	
Off-site Transportation of HC Waste	
Storage of HCW	
Activity 2: Storage of Waste (30 mins)	
Waste Treatment Technologies	
Options for Treatment of HCW	
Activity 3 – Segregation of HCW (1 Hour)	
SESSION 4 OCCUPATIONAL SAFETY AND HEALTH	45 Mins
Occupational Health Impact	
Personal Hygiene and Hand Hygiene	
Safety of Healthcare Workers	
Occupational Post-Exposure Prophylaxis (OPEP)	
Emergency Response in case of Leakage	
Infection Prevention and Control Measures	
Role and Responsibility in Infection Prevention and Control	
SESSION 5 FACILITY WALKTHROUGH AND DISCUSSION	1 Hr

SESSION 1: INTRODUCTION OF HCWM

Objective: The main objective of this session is to understand the situation of health care waste management in Nepal	TRAINING TOOLS <ul style="list-style-type: none">• Presentation• Group Discussion• Brain Storming	Time 45 Mins
---	--	------------------------

By the end of the session participants will be able to

- Understand Situational Analysis of Health Care Waste Management in Nepal
- Access the existing national legislation, Policy and strategies and existing national guidelines and directives on HCWM and WASH
- Understand Risk of HCW for Human beings
- Principle of HCWM and Environmental Health
- Get insight on the Concept of Zero waste, waste minimization and Circular Economy

1.1 Situation of Health Care Waste Management (HCWM) in Nepal

Videos related to Environment Health, Health Care Wash management and WASH in Nepal and WASH in Health Care Facilities to be displayed.

Video links that can be used as a resource material during session:

Healthcare Waste Management and WASH in Nepal (by GIZ Health Nepal):

<https://www.youtube.com/watch?v=uplhe6mbDuc>

1.2 Importance of Health Care Waste Management

HCWM is important in any health sector and institution in many aspects such as:

- To minimize the effect of waste on public health, such as disease transmission (e.g., HIV/AIDS, hepatitis B and hepatitis C) and injuries caused by sharps.
- To prevent risks and hazards to staffs handling wastes.
- To reduce the environmental impact caused by pollution resulting from improper disposal of waste
- To facilitate resource recovery of useful and reusable products.
- To improve on aesthetics and ensure clean environment within HCF
- To prevent and control breeding of insects, rodents, and other pests.

1.3 Risk of HCW for Human Beings

Healthcare waste contains potentially harmful microorganisms that can infect hospital patients, health workers and the general public. Other potential hazards may include drug-resistant microorganisms which spread from health facilities into the environment.

Adverse health risks associated with health care waste and by products includes:

- Sharps imposed injuries;
- toxic exposure to pharmaceutical products, such as antibiotics and cytotoxic drugs released into the surrounding environment
- chemical burns arising in the context of disinfection, sterilization or waste treatment activities;

1.4 Regulations, Policy, Existing National Guidelines and Directives on HCWM

In Nepal, laws and policies related to the HCWM have been formulated at different times, but compliance with those laws and regulations and implementation is one of the main challenges. Endorsement of policies, acts, rules and regulations related to HCWM, hold health care facilities accountable to their responsibilities regarding the management of health care waste. Some of the relevant documents are outlined as below:

- **The Constitution of Nepal 2015/2072**

Regarding the protection of human rights, Section 35 of the constitution states that every citizen shall have the right to seek basic health care services from the state and have right to access to clean water and sanitation.

Section 30 ensures the right to clean environment. It states that every citizen shall have the right to live in a clean and healthy environment. For any injury caused from environmental pollution or degradation, the victim shall have the right to obtain compensation, in accordance with law. This Article shall not prevent the making of necessary legal provisions for a proper balance between the environment and development.

- **Guideline for Health Institutions Establishment, Operation and Upgrade Standard 2014/2071**

This guideline contains the code of conducts required for the operation of health institutions. This guideline deals with the infrastructure and standards required for the operation of health institutions like emergency services, outpatient department and in-patient services, pharmacy, emergency preparedness, waste disposal and management and all other prerequisites.

- **National Healthcare Waste Management Standards and Operating Procedures, 2020**

The “National Healthcare Waste Management Standards and Operating Procedures, 2020” covers all aspects of HCWM such as development of HCWM implementation plan, management and oversight and technical aspects related to waste management such as waste minimization, waste segregation, collection, storage, transportation, treatment, disposal and capacity-building and awareness creation.

1.5 Principle for Healthcare Waste Management

Zero Waste Concept

The concept of zero waste is a summary of the principles centered on waste management that promotes the promotion of waste recycling frameworks based on the life cycle of waste mitigation. Its purpose is to prevent waste from being buried underground, incinerated and dumped in water sources. The concept of zero waste encourages proper management, reduction and disposal of resources.

Waste Minimization

Waste minimization is defined as both the prevention as well as the reduction of waste production. Waste minimization usually benefits the waste producer by reducing the costs for the purchase of goods. It involves specific strategies of changes in management and behavior. Waste minimization can be achieved through:

- Waste reduction at source (product substitution, product change, procedural change)
- Giving preference to recyclable and reusable items

Benefits of Waste Minimization:

- Improves worker safety
- Reduces environmental impact and improves public health
- Reduces cost of waste disposal

Examples of Waste Minimization in HCF

Source Reduction	Recovery and Reuse	Recycling	Composting
<ul style="list-style-type: none">• Environmentally preferable purchasing• Inventory control in pharmacy and stockroom• Employing reusable and recycled products	<ul style="list-style-type: none">• Solvent recovery in the hospital laboratory• Silver recovery in the x-ray department	<ul style="list-style-type: none">• Recycling office paper, newspapers, aluminum cans, glass bottles, construction debris, printer toners, etc	<ul style="list-style-type: none">• Composting of kitchen waste and yard waste

(Source: Global Healthcare Waste Project Module 11: Healthcare Waste Minimization)

SESSION 2: HEALTH CARE WASTE MANAGEMENT

Objective: The main objective of this session is to understand the concept of health care waste management and learn about the types of waste generated along with its segregation and transportation.	TRAINING TOOLS <ul style="list-style-type: none">• Interactive Presentation• Group Discussion• Group Activities• Q &A	Time 1 Hr 45 min
--	---	----------------------------

By the End of the session Participants will be able to

- Understand the terms and definitions of HCW and its sources
- Classify waste generated within the HCFs
- Understand the segregation and collection methods
- Learn about the onsite and offsite waste transportation of HCW

2.1 Definition and Sources of Health Care Waste

Waste generated through all medical activities is termed as Health Care waste. Medical activities include activities such as diagnosis, preventive, curative and palliative treatments, research pertaining to the above activities and production or testing of biologicals.

Sources of HCW are:

- Hospitals
- Primary health care centres, health posts, sub-health posts, Expanded Programme on Immunization (EPI) clinics, primary health care outreach clinics (PHC ORC)
- Clinics (medical, primary health care, alternative medicines, dental, maternity homes, dialysis centres, physician offices)
- Laboratories and research centres (medical and biomedical laboratories, medical research centres and institutions, blood banks and blood collection centres, biotechnology laboratories, pathological laboratories, microbiological laboratories)
- Pharmacies and medical stores
- Institutions (medical, nursing home, dental, nursing, paramedics, drug rehabilitation centres, drop in centre)
- Veterinary hospitals and clinics
- Ambulance and emergency care
- Home based care

2.2 Classification of Health Care waste

Table 1: Classification of HCW

Health Care Waste (HCW)		
Non Risk HCW	Biodegradable	Biodegradable waste can be decomposed like leftover food, garden waste
	Non-Biodegradable	Non- Biodegradable waste does not decompose, but its large volume can be recycled. It includes bottles and cans, paper, different plastics and glass
Risk HCW	Infectious Waste	Infectious wastes consist of pathogens and its contamination poses a risk of disease transmission. This category includes waste contaminated with blood and other body fluids, laboratory cultures and microbiological stocks and waste including excreta and other materials that have been in contact with patients infected with highly infectious diseases.
	Sharp Waste	Sharps are all objects and materials capable of cutting or penetrating the skin. These wastes pose a potential risk of injury and infection due to their puncturing or cutting properties. Examples of such wastes include all types of needles, broken glass ware, ampoules, scalpel blades, lancets, cover slips, glass slides, vials without content.
	Pharmaceutical Waste	Pharmaceuticals that have passed their recommended shelf life or pharmaceuticals that are unusable.
	Cytotoxic Waste	Cytotoxic wastes can arise by use (administration to patients) or by manufacture and preparation of pharmaceuticals with a cytotoxic effect.
	Pathological Waste	Pathological waste consists of human body parts, organs and tissues. Examples of such wastes are tissue waste, removed organs, amputated body parts, placentas, blood, body fluids, human fetus, animal and carcasses obtained through medical procedures.
	Chemical Waste	Chemical waste is the waste with chemicals, which if managed or disposed improperly may pose substantial hazards to human health. It includes chemicals used in the laboratory, unused photo film, contaminants, solvents, batteries, broken thermometers and blood pressure measuring equipments
	Radioactive Waste	Materials contaminated with radionuclides, which arise from the medical or research use of radionuclides. It includes unused sealed radiation source, liquid and gaseous material contaminated with radionuclide, excreta of patients who underwent radionuclide diagnostic and therapeutic applications, paper cups, straws, needle syringes, test tubes and tap water used to wash paraphernalia.

Activity 1: Types of Waste**Time: 1 hour**

Objective: Through this session, participants will be able to differentiate the type of waste (general and hazardous waste).

Preparation:

1. Write down the categories of health care waste as shown below into the meta card (rectangular thick paper)

BIODEGRADABLE	PAPER	PLASTIC, BOTTLE AND CANS
INFECTIOUS	PHARMACEUTICALS	SHARP GLASS
SHARP METAL	UNBROKEN GLASS	PATHOLOGICAL
CYTOTOXIC	CHEMICAL	RADIOACTIVE

2. Write the examples of waste of the categories in other metacards as shown in the given table

Waste Categories	Examples of waste
BIODEGRADABLE	Fruit peelings, rice, biscuit, doughnut, nuts, plant, leaves, etc
PAPER	Newspaper, bills, photocopy papers, etc
PLASTIC, BOTTLE AND CAN	Plastic wrappers, polythene bags, water bottles, cans, distilled water bottle, saline bottle, etc
INFECTIOUS	Tissue paper, Gauze, Cotton, Mask, Blood bag, Syringe, etc
PHARMACEUTICALS	Date expired medicines, leftover medicines of patients, damaged medicine etc
SHARP GLASS	Broken ampoule, broken CFL tube, broken bangles etc
SHARP METAL	Needles, blade, scalpel, scissors, etc
UNBROKEN GLASS	Medicine vials, glass bottles, etc
PATHOLOGICAL	Placenta, Tumor, amputated leg
CYTOTOXIC	Medicines used for cancer patient, cytotoxic drugs etc
CHEMICAL	Aerosol, Harpic, Phenol, Hypochloric acid, etc
RADIOACTIVE	Radioactive substances (such as unused liquids from radiotherapy or lab research), glassware, packages, or absorbent paper contaminated with radioactive substance, urine and excreta from patients treated or tested with radionuclides and sealed sources (containers in which radioactive substances are stored and sealed).

3. Make at least 5 to 7 examples of waste of each category.
4. Jumble up all the examples of waste (meta cards)

Activities:







1. Stick the waste categories on the wall with the help of masking tape
2. Distribute the examples of waste to the participants (3 to 4 examples to each participant)
3. Ask them to stick the examples in the respective categories of HCW simultaneously.
4. After the participants finish their job, check the categories with examples. Readout loud the examples of the categories one by one and correct if it's wrong.

2.3 Waste Segregation

Waste segregation refers to the separation of different waste at the source and keeping them apart during handling, collection, interim storage and transportation. Segregation of the waste at point of generation is very crucial for a successful management of HCW. It is highly recommended to segregate HCW on-site at the time waste generation, e.g. when an injection is given, needle and syringe are deposited in their respective, different waste containers.

To reduce the amount of infectious waste as low as possible, infectious waste should not be mixed with non-infectious waste. Separating risky waste from non-risk waste also significantly reduces the risk of infection for staff and healthcare workers dealing with HCW. A suggested way of distinguishing HCW categories is by sorting the waste into color-coded and well-labelled containers. The use of colour-coding and marking helps to easily segregate waste and identify the different categories of waste. Table 2 illustrates the recommended color codes for HCFs in Nepal.

Table 2: Recommended color-codes for the container, labelling and international signs for HCW

Waste Category, symbol and label		Color of the	
Non-risk HCW	Biodegradable	Green	
	Non-biodegradable	Blue	
Risk HCW	Pathological waste	 Danger! Pathological waste	Red
	Sharps Waste	 Danger! Contaminated sharps	Red
	Infectious Waste	 Infectious	Red
	Pharmaceuticals waste		Red
	Cytotoxic Waste		Red
	Chemical Waste	 Danger! To be discarded by authorized staff only	Yellow
	Radioactive Waste	 Danger! Radioactive Waste	Black

(Source:MOHP-2020)¹

¹ MoHP (2020), National Healthcare Waste Management Standards and Operating Procedures 2020,

SESSION 3: HEALTHCARE WASTE COLLECTION, TRANSPORTATION, WASTE STORAGE AND TREATMENT

Objective: The main objective of this session is to know about waste collection, transportation and storage methods for various setting of health care wastes	TRAINING TOOLS <ul style="list-style-type: none">• Interactive Presentation• Group Discussion• Q &A	Time 2 Hr 15 Mins
---	--	-----------------------------

By the End of the session Participants will be able to

- Understand about waste collection methods
- Learn about onsite the transportation of HCW
- Know about waste storage options along with waste treatment options

3.1 Health Care Waste Collection

Waste generated within the HCFs are collected in different sized color coded buckets or bins in accordance with type and quantity of waste. Waste collected are stored properly in utility room or temporary storage before it is transferred to final waste treatment area. If designated waste storage area is not available, infectious waste can be stored at the proper place away from patients and public areas. Waste need to be collected and transported away in daily basis. Proper coded storage bins should be used for waste collection.



Figure 1: Waste Collection Bins, Bucket with Medication trolley and stand²

² Photo Source: Eco Concern Pvt. Ltd

Health Care waste collection and transportation activities should be designed and planned to ensure safe movement of waste from point of generation to the storage and ultimately to treatment center. Proper plan should be prepared for collection and transportation of waste.

Recommendations to the staff involved in waste collection:

- Collect waste on room to room basis once every shift. In case of difficulty in the collection of waste in every shift, waste should be collected on daily basis (or as frequently as required) and transported to the designated central storage site of HCF.
- No bags should be removed unless they are labelled with their point of production (hospital and ward or department) and contents.
- The bags or containers should be replaced immediately with new ones of the same type.
- A supply of fresh collection bags or containers should be readily available at all locations where waste is produced.

Process for on-site and off-site transportation of waste should be included in the waste disposal plan of HCF.

3.2 On-site transportation of HC Waste

Onsite transportation should be planned avoiding the busy and peak hours with higher flow of patients. During transportation of waste, segregated waste should not mix with each other and need to be managed in accordance with the level of risk of waste.

Wheel trolleys, containers and carts should be used to transport waste from point of generation to the collection area. Wherever possible, dedicated waste transportation route should be allocated for transportation of HCW to reduce the passage of loaded carts through wards and other areas. General waste and hazardous waste should be transported separately. Infectious waste can be transported with sharp waste but not with other hazardous waste



Figure 2 : Trolleys for Onsite Transportation of HCW³

³ MOH (2015) Government of Kenya; Guide for Training Health Workers in Health Care Waste Management, https://path.azureedge.net/media/documents/DT_guide_train_waste_man_kenya_moh.pdf

Transportation Trolley

Health care waste needs to be transported in wheel trolleys for safe handling. The trolleys used for health care waste transportation should not be used for any other purposes. Generally, two types of trolleys are used in health care setting, one for transporting waste within a unit, e.g. a medication trolley with containers for the separation of waste at source. The second trolley is for the transportation from the source to the collection point, i.e. from the different units to the storage unit or treatment site.

Wheeled containers, trolleys or carts used for transferring health-care waste within health-care facilities should be designed and constructed with following considerations:

- Separate bins for different types of waste are available.
- Risk waste and general waste are distinctly separated on opposing sides of the trolley, i.e. risk waste on the left, general waste on the right to avoid mixing and confusion during segregation.
- Edges on the trolley are blunt, not to tear the bags with waste during loading and unloading.
- The base of the trolley or cart should have provision to retain any leakage from the damaged or teared waste bags.
- The surface and material of the trolley should be smooth so it can easily be cleaned, disinfected and drained.
- The waste may be easily loaded, secured and unloaded.

For the transportation from source to collection point, there should be separate trolleys for the transportation of risk and general waste. Trolleys and collection vehicles must be cleaned and disinfected daily using chlorine solution and phenolic compounds. The people transporting the waste should be equipped with appropriate protective equipment.

3.3 Offsite transportation of HC Waste

The waste produced from healthcare facility should be transported offsite for proper disposal and treatment. the HCW producer is responsible for safe packaging and appropriate labelling of the waste to be transported offsite as well as for the authorization of its destination i.e. CTF and need to be safely disposed at landfill site after proper treatment.



*Figure 3: Transportation trolley for infectious waste
(Photo Source: Eco Concern Pvt. Ltd)*

A fundamental requirement for vehicle transporting hazardous waste should be roadworthy and be labelled with information such as its load, and its payload for minimizing risk of accidents and spillages. The responsibility of transportation of solid waste from collection point to transformation center and up to waste management point lies to local government or organization or body assigned by local government as per the Solid Waste Management Act 2068(2011) with amendment version of 2074 Kartik.

3.4 Storage of HCW

Waste should be collected and transferred to the central storage within the health facility to prevent the accumulation of waste before treatment and relocation. The maximum storage period for infectious waste before treatment or disposal is 48 hours in winter and 24 hours in summer. Waste storage site should be within the premises of the health institution. When allocating space for this, attention should be paid to the amount of waste produced, garbage collection rate, re-treatment and other means of disposal.

Wastes of each category should be stored separately and labeled in a clear manner as shown in figure 4. For example, infectious waste should not be mixed with medicinal waste.



Figure 4 : Waste Storage area with for different category of wastes (Photo Source: Eco Concern Pvt. Ltd)

In order to have complete control over the waste management system, records of stored waste, treated waste and disposal date of related waste etc. should be kept. All the health-related collected wastes should be deposited in the storage area until transported to the prescribed treatment center. Storage area should be separate from the patient's room, laboratory, hospital venue, operating room or any place that is easily accessible to the public. Such storage area should be locked, hygienic and with appropriate signs.

Activity 2: Waste Storage

Ask participants to describe cases from their health facility in which they have observed poor storage of waste. List examples on a flip chart and ask them to suggest what should have been the correct practice for each of the listed items.

3.5 Waste Treatment Technologies

The methods for treatment and disposal of HCWs depend on specific factors applicable to the HCF, relevant legislation and environmental aspects affecting the public. The bulk of HCW falls into the category of non-hazardous HCW, much of which can be recycled or reused. With correct segregation, low amounts of waste are categorized as risk HCW requiring specific attention. Hazardous waste and infectious waste must be treated with approved treatment methods. Once treated, the waste may be re-classified for disposal. As technology changes, HCFs should evaluate treatment alternatives regarding their safety, effectiveness, environmental impacts, costs and compliance with the country requirements. The techniques listed in Table are currently available for the treatment and disposal of HCW.

Table 3: Techniques currently available for the treatment and disposal of HCW

Biological Procedures	Composting	Composting is the natural, biological decomposition of organic matter by fungi, bacteria, insects, worms and other organisms. Successful composting entails the management of the decomposition process so that it is relatively quick, safe and clean.
	Vermi composting	Vermicomposting is the process of degradation of biodegradable matter through worms. The specialized worms used can speed up the digestion process through the vigorous digestion of the materials.
	Anaerobic Digestion	During anaerobic digestion biodegradable waste is degraded in absence of oxygen. The process occurs due to anaerobic organisms, which results in production of methane as a by-product.
Steam-based treatments:	Autoclaving	Autoclave is a process of steam sterilization under pressure. It is a low heat process in which steam is brought into direct contact with the waste material for a sufficient duration to disinfect the material. This technique has been used for a long time in HCFs for sterilization of reusable medical equipment.
	Microwave	Microwave treatment is a steam-based treatment technology where microwave energy generates moist heat and steam by heating the moisture in the waste.
	Frictional Heat Treatment	Frictional Heat Treatment: This technology uses both steam as well as dry heat. High-speed rotating shredders generate heat and the moisture in the waste turns into steam.
	Integrated steam-based treatment system	Integrated steam-based treatment system: The integrated steam-based systems combine internal shredding, steam treatment-mixing and drying in a continuous unit. Since most autoclaves and hybrid autoclaves operate in batch processes, these technologies are sometime referred as advanced steam treatment technologies treating waste in continuous process (WHO 2014)
Chemical treatment	Chemical Disinfectants, Alkaline hydrolysis, Chemical decomposition are Chemical treatment methods.	
Burial based Disposal Methods	Encapsulation and Inertization	Encapsulation and Inertization: Encapsulation involves the filling of the containers with waste, adding an immobilizing material and sealing the container. The process uses either cubic boxes made of high- density polyethylene or metallic drums. When containers are three quarters filled with sharps, pharmaceuticals and chemical waste, an immobilizing agent

	such as plastic foam, bituminous sand, cement mortar or clay is poured into it. The material dries and the container is sealed and disposed safely.
Inertization	Inertization: In this technique, HCW is mixed with cement and other substances in a composition of 65% waste, 15% lime, 15% cement and 5% water. The formed mixture is allowed to set into cubes or pellets and then is transported to a suitable storage site.
Sanitary landfill	Sanitary landfill: Sanitary landfills are an engineered method, designed and constructed to keep the waste isolated from the environment. There should not be any contamination of the soil, surface, and ground water.
Burial	Burial: Hazardous waste can be buried in a special pit. The bottom of the pit should be at least 2 m above the water table. When the level of the waste reaches up to 30 to 50 cm to the surface of the ground, the pit needs to be filled with dirt, sealed with concrete and a new pit should be dug if necessary.
Septic or Concrete Vault	Septic or Concrete Vault: This method can be used for the disposal of used sharps and syringes. In this method a concrete pit of slabs is constructed to accommodate sharps and syringes for certain period without contaminating the ground water level.

3.6 Options for Treatment of HCW

According to the Solid Waste Management Act, 2068, treatment and management of hazardous health waste, chemical waste or industrial waste is the responsibility of the producer. Therefore, the responsibility of managing health care waste lies with the head of the health institution.

The following table shows the appropriate treatment technologies for treating various health care wastes.

Table 4: Treatment technologies for treating various health care wastes

Waste Treatment Method	Infectious Waste	Sharp Waste	Pathological Waste	Chemical Waste	Pharmaceutical Waste	Cytotoxic Waste
Biological Procedure	X	X	✓	X	X	X
Autoclave	✓	✓	X	X	X	X
Microwave	✓	✓	X	X	X	X
Chemical Treatment	✓	✓	X	✓	X	✓
Encapsulation and Inertization	X	✓	X	✓	✓	✓
Sanitary landfill	✓ #	✓ *	X	✓ *	✓ *	✓ *
Burial	✓ #	✓ #	✓	X	X	X
Septic or Concrete Vault	✓ #	✓	X	X	X	X

* After Encapsulation # After Sterilization

Activity 3: Segregation of HCW

Time: 1 hour

Objective: Through this session, participants will be able to gain practical knowledge of waste segregation.

Items required:

1. Fake HCW (all waste that is generated in a HCF that is non-contagious that includes paper, plastic, unused gauze, unused cotton, unused syringes, water bottles, unused gloves, unused bloodbag, empty vials, xray sheets, newspaper, plastic wrappers, polythene bags, plastic cups, medicine box, etc)

Note: Never include sharp objects like needles, broken glass while preparing fake waste.

2. Medication trolley with bins
3. One set of well labeled color-coded General waste segregation bins (50 L)
4. 50 L well-labeled red bucket
5. Segregation signage
6. Tongs
7. PPE

Preparation

- Prepare fake HCW and mix thoroughly in a 50-liter bucket.
- Allocate space for practice.
- Arrange the medication trolley, general waste bucket, risk waste buckets and other items before conducting the practical.

Activities

1. At first, brief the segregation system to the participants
2. Ask one participant to volunteer for segregation
3. Provide PPE to the volunteer and ask him/her to wear it following the step of PPE donning.
4. Provide tong and ask the volunteer to separate the waste.
5. Involve other participants around and ask them to watch for proper segregation and help the volunteer.
6. After the segregation is complete, ask another participant to find out the mistake
7. Check each segregation bin and correct any mistakes.
8. Ask the volunteer to doff the PPE following the steps.

SESSION 4: OCCUPATIONAL SAFETY AND HEALTH

Objective: The main objective of this session is to get an insight on occupational safety and health	Training Tools <ul style="list-style-type: none">• Interactive Presentation• Group Discussion• Q &A	Time 45 Mins
---	---	-----------------

By the End of the session Participants will be able to

- Understand Occupational hazard and risk to health workers Health Impact from HCW
- Understand use and limitations of personal protective equipment
- Get insight on ways to reduce occupational hazards, spill management and risk waste management, post exposure prophylaxis

4.1 Occupational Health Impact

All Individuals exposed to hazardous HCW are potentially at risk of being infected. The potential healthcare workers at risk are:

- i. Medical staff – doctors, nurses, paramedics, pharmacists, laboratory technologists, sanitary staffs and hospital maintenance personnel
- ii. In and out patients receiving treatment in HCFs as well as their relatives
- iii. HCFs support staffs involved in services such as laundry, waste handling and transportation,
- iv. Workers involved in waste disposal facilities and,
- v. General public

The medical and auxiliary staff can be infected with wastes if not properly packed during handling of waste especially the infectious and sharps. These wastes contain variety of pathogenic microorganisms which may infect the human body through pathways such as crack or cut in the skin (injection). Unsafe disposal of HCW such as contaminated syringes and needles poses health risks to medical personnel.

4.2 Personal hygiene and hand hygiene

Basic personal hygiene is important for minimizing the risks during healthcare waste handling, and there should be easy access to hand washing for the staffs and individuals involved with healthcare waste. As there is a risk of infection from the hands of health workers, both hand washing and cleansing are the primary prevention measures. Infections can be prevented by using standard methods of hand washing. It is mandatory to wash hands with soap and water when in contact with wastes and also after examining patients to avoid all kinds of infections. Pure alcohols or alcohol-based compounds are quick and effective. If infected cells or body fluids are touched with non-gloved hands, it should be washed with soapy water or disinfected alcohol. Figure 4 illustrates steps for Handwashing.



Figure 5 : Steps of Hand Washing (Source: WHO Guideline on handwashing ⁴)

4.3 Safety of Healthcare workers

Handling of potentially hazardous and infectious waste includes production, segregation, collection, transportation, treatment and disposal of HCW. Those who work in potentially hazardous and contagious health-related waste should be personally protected from the risk of injury. The person involved in health waste management should ensure that all risks have been identified and necessary safety measures have been taken. When preparing a health waste management plan, all the risks associated with such waste should be assessed, which will help in identifying the necessary safety measures. When designing such a system, there should be a level of protection against hazardous

⁴ WHO Guideline on handwashing : https://www.who.int/gpsc/5may/How_To_HandWash_Poster.pdf

waste or contact with other hazards or keeping such contact within safe limits (WHO 1999) (2076). Appropriate training should be given to the concerned staff in this regard.

Personal Protective Equipment

Risks to healthcare workers depends to some extent on what kind of clothes are worn or whether protective equipment have been used or not. The following materials should be provided to the persons directly involved in the collection and operation of health-related waste:

- A cap with or without a helmet or visor, depending on the nature of the work.
- Face mask, depending on the nature of the work.
- Disposable gloves, utility gloves or heavy-duty gloves (for cleaners and healthcare waste handlers), both mandatory,
- Eye protection goggles for eye protection,
- Apron mandatory,
- Leg protector or boot mandatory

Boots and heavy-duty gloves are especially needed for cleaners. The thick sole of the boot provides protection against spillage and slippery debris when entering the storage area. If not properly segregated, needles and other sharp debris may be placed in a plastic bag, may harm the waste handlers. So, leg protector should be used while handling healthcare wastes.



Figure 6: Waste Handlers with PPE while handling the HCW (source : ⁵)

⁵ <https://www.cehjournal.org/article/case-study-safe-waste-disposal-within-the-eye-care-clinic-hospital/>

Vaccination and Needle-Stick Protection

There have been cases of health workers and cleaners being infected with viral hepatitis. Therefore, vaccination against it is recommended. Such cleaners should be vaccinated against tetanus as well. Medical professionals and health workers should be made aware of the needle-stick protection. The use of needles in health care is common all over the world. In developed and developing countries alone, 16 billion injections are given annually. Safe needles do not harm users, do not pose a risk to health workers, and are not considered as hazardous waste. The practice of using unsafe needles, such as reusing syringes and needles without treatment must be discouraged. The disposable syringe and the needles should be cut, squeezed and made unusable after use and disposed safely.

Injuries and Exposure to hazardous Materials

The health organization should have a program in place to deal with injuries or exposure to hazardous materials. Sweepers who handle health-related wastes should be trained on what to do when injured and in contact.

The training program should include the following:

- Immediate first aid treatment, such as cleaning the injured area or wound, if eyes rinse with clean water.
- Immediately inform the designated responsible person.
- Identify the cause of the incident as much as possible and get detailed information of the cause for infection prevention
- Have additional medical monitoring of the accident,
- Contact the Department of Emergency or Occupational Health as soon as possible, Provide medicines for health protection after direct contact with the hazardous waste
- Medical monitoring.
- Carryout blood and other tests if necessary.
- Keep records of the incident.
- Investigate the accident and take corrective action to prevent such incident from happening again in future.

Spillage management

In case of leakage or spillage of hazardous fluid, PPE such as gloves and gowns, eye protection material and mask should be worn while cleaning. Respiratory equipment (gas masks) may be required for risky activities such as cleaning toxic dust, incinerator residue or infected equipment. Wastes should be collected and packed safely with the help of shovels. Special care should be taken especially if there is mercury spillage. In case of spillage or leakage of contaminated material, the floor should be cleaned and sanitized immediately after collection of spilled material.

4.4 Occupational Post-Exposure Prophylaxis (OPEP)

Occupational Post-Exposure Prophylaxis (OPEP) is the Short-term treatment that starts as soon as possible after high-risk occupational exposure to an infectious agent, such as HIV, hepatitis B virus (HBV), or hepatitis C virus (HCV). One of the example of a high-risk occupational exposure is exposure to an infectious agent as the result of a needle stick injury in a health care facility. The purpose of OPEP is to reduce the risk of infection. If an occupational exposure occurs, the circumstances and post exposure management should be recorded. The following measures should be followed for OPEP ⁶:

- **date and time of exposure** should be recorded,
- information such as **where and how the exposure occurred**, and if the exposure was related to a sharp device, the type of device and how and when in the course of handling the device the exposure occurred should be noted
- **details of the exposure** including the type and the severity of the exposure (e.g., for a percutaneous exposure, depth of injury and whether the fluid was injected; or for a skin or mucous-membrane exposure, the estimated volume of material and duration of contact and the condition of the skin [e.g., chapped, abraded, or intact]) should be recorded

4.5 Emergency Response in case of Leakage

Spill and leakage of infectious and other hazardous materials are an emergency situation in a health care facility. Waste may spill or leak unknowingly, during its transportation within the HCFs. Waste may be spilled or dropped by accidents like colliding, falling or breaking of the containers and sometimes it can be due to full and leaky containers during transfer.

The following are some of the activities to be done in case of such leakage:

- Clear the contaminated area.
- Immediately wash the eyes, skin by the exposed person.
- Inform supervisor for additional work to be done in such a situation.
- Use PPE before cleaning and properly disinfect the contaminated material and area.
- Collect all spilled material (in case of spillage of blood or other liquids, spray 0.5% chlorine, wait for 10 minutes before collection, if case of chemical product, disinfect it before picking it up).
- In case of leakage of liquid, use dry cloth. Similarly, when a solid object is spilled, wipe with a cloth soaked in water.
- Thoroughly clean the spilled area and wipe with an absorbing cloth.
- If skin is in contact with any hazardous material, it should be washed, cleaned and disinfected immediately.
- If burning chemical substance gets in the eyes, continuously rinse eyes with water for 10 to 30 minutes to wash it.

⁶ Guidelines for the Management of Health-Care Worker Exposures to HIV and Recommendations for Postexposure Prophylaxis. *Arch Dermatol.* 1998;134(10):1317–1318. doi:10.1001/archderm.134.10.1317 (for oPEP)

4.6 Infection Prevention and Control Measures

All Health care workers and patients are at the risk of infection. Therefore, prevention and control of infection is everyone's responsibility. While entering into the Health Care Facilities, the staff, patients and visitors can come in contact with the disease. However, in most cases the infection can be prevented from spreading. The only way to prevent the spreading of infection is to avoid the human contact with the germs.

The best way to prevent infection is to follow the standards, which includes the following:

- Wash hands thoroughly with soap and water regularly.
- Use personal protective equipment such as gloves, eye protection materials, face masks and gowns.
- Use tweezers to separate the waste.
- Take precaution to avoid injury while using sharp tools.
- Treat the equipment and tools used in the treatment properly.
- Adopt proper environmental sanitation and waste management practices.

4.7 Role and responsibility in infection prevention and control

- i. All healthcare staffs and service receivers involved with healthcare facilities are at risk of having infections. So, it is the responsibility of everyone for infection prevention.
- ii. Employees should be properly trained for precautions according to infection control standards and ensure adequate cleaning and infection prevention equipment and personal safety equipment are provided.
- iii. Beds, floors, walls, toilets, showers, appliances and health facilities should be cleaned and disinfected regularly to ensure that all the HCF clean and disinfected.
- iv. Medical equipment should be cleaned, Disinfected and sterilized as per requirement.
- v. The designated areas should have adequate number of separate toilets, showers, laundry facilities and waste disposal facilities.
- vi. To eliminate contamination of defecation or vomiting in specified environment (such as isolation of cholera patients) half a cup of 0.5% chlorine solution will be used for 10 minutes.
- vii. Any area contaminated with blood, feces, vomit or body fluids should be cleaned and decontaminated immediately.
- viii. Laundry soap and detergent should be used for the contaminated clothes and linen kept in separate bags. When washed in washing machine a temperature of 60 to 90 degrees should be maintained. If washing machine is not available, the clothes should be cleaned using a solution of soap and water and stirred using a stick in a large container or drum. After some time, empty the large container and drum and soak the linen cloths in 0.05% sodium hypochlorite for 30 minutes. Finally rinse with clean water and dry the cloth thoroughly (as much as possible in the sun).
- ix. Clean and dirty linen should be stored and transported separately in bags with marked labels.
- x. Beds, mattresses, and pillows, which are contaminated with blood or fluid from the body, should be re-cleaned after each patient.
- xi. The distance between the beds in the ward should have maintained a distance of 4 feet.

- xii. In the event of an outbreak, patients and caregivers should be given adequate counseling and advice on the necessary personal infection control practices within 30 minutes of arriving at the health facility.
- xiii. Adequate management of corpses should be done to prevent the spread of infectious diseases.
- xiv. Open defecation is a serious public health risk in any environment. In addition to constructing additional toilets and increasing the number of sanitation workers, if necessary, the concerned health institution should immediately conduct sanitation awareness campaign.
- xv. Health organizations should take the following level of precautions to prevent infection:
 - a. by making full use of the 6 steps of hand washing.
 - b. Wearing personal protective equipment (PPE) such as gloves, eye protection goggles, mask, apron.
 - c. Maintaining proper environmental sanitation and waste disposal practice.
 - d. By preventing injuries caused by sharp objects.
- xvi. Special care must be taken in the operation theatre/ICU, such as using separate shoes, gowns, and food.

SESSION 5: FACILITY WALKTHROUGH AND DISCUSSION

Objective: The participants will understand better the work environment, its surroundings and the risks they are exposed to if not carefully instructed about how the work areas should be handled through this session	TRAINING TOOLS <ul style="list-style-type: none"> • Field visit • Discussion • Q & A 	Time 1 hour
---	--	-----------------------

FIELD VISIT (facility walkthrough)

Groups will be divided and the participants will be taken for a walkthrough in one or two units of the health care facility. A group leader will be selected in each group and ground rules will be strictly executed during the visit so that no one is off track. The group leader will ensure that proper discipline and silence are maintained throughout the visit. After the unit/ward visit, the inclusive health care waste management system will be observed and noted.

Observations during walkthrough session:

Description	Things to be observed
Waste Containers and segregation inside the units/wards	<ul style="list-style-type: none"> • Observe waste segregation practices. • Observe color-coded bins and note the contents. • Evaluate the level of segregation. Are there enough bins in the ward/department? • Observe the locations of the bins
Waste Collection and Transportation	<ul style="list-style-type: none"> • Observe the mode of collection and onsite transportation. • Evaluate the route of transportation. • Evaluate the frequency and times of collection. • Observe the type of collection carts or trolleys being used • Are the waste handlers using proper PPE?
Final Disposal	<p>Observe the final disposal practice of HCW. What happens to the waste at the end? (recycles, burns, buries, or municipal disposal?)</p> <p>Observe the Waste storage area if available and evaluate:</p> <ul style="list-style-type: none"> • Location, surroundings, access • Overall cleanliness • Labelling and signs

DISCUSSION

After the walkthrough session the participants will later share their findings and observations made. Each group will be provided with a chart paper and asked to note down the following;

- The HCW problems and difficulties at the unit/ward and ways of improvements
- Current waste collection and transportation practices; ideas of waste transportation route and frequency
- Final disposal practices
- Overall recommendation and suggestion

Each group will be given 15 minutes for discussion. After the group is ready, one of the participants from each group makes a presentation. The discussion will be further provoked by the trainer and the provided feedback will be noted.

Q & A

After the round of discussion, the participants will be asked if they have any queries related to the overall training sessions. The training will then be ended after a short Q & A round.