

# NURSING LEVEL-III

**Based on January 2022, Curriculum Version I**



**Module Title: Apply Infection Prevention Techniques**

**Module Code: HLT NUR3 M03 0122**

**Nominal Duration: 96 Hours**

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Page 1 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

## Table of content

<b>ACRONYMS.....</b>	<b>4</b>
<b>INTRODUCTION .....</b>	<b>5</b>
<b>UNIT ONE: IDENTIFY CAUSES OF DISEASE.....</b>	<b>7</b>
1.1. CAUSES OF INFECTIONS DISEASE .....	8
1.2. INFECTION CYCLE/CHAIN .....	10
<b>SELF-CHECK-1 .....</b>	<b>14</b>
<b>UNIT TWO: APPLY INFECTION PREVENTION TECHNIQUES .....</b>	<b>15</b>
2.1. ESSENTIAL ELEMENTS OF INFECTION PREVENTION .....	16
2.2. STANDARD PRECAUTION .....	18
2.3. TRANSMISSION BASED PRECAUTION .....	20
2.4. INSTRUMENT PROCESSING .....	27
2.5. INFECTIOUS WASTE MANAGEMENT .....	49
2.6. PERSONAL PROTECTIVE EQUIPMENT (PPE) .....	57
2.7. HAND WASHING .....	70
<b>SELF-CHECK-2 .....</b>	<b>78</b>
<b>OPERATION SHEET-1 .....</b>	<b>79</b>
<b>UNIT THREE: LIMIT CONTAMINATION.....</b>	<b>81</b>
3.1. DEMARCATING AND MAINTAINING CLEAN AND CONTAMINATED ZONES .....	82
3.2. KEEP RECORDS, MATERIALS AND MEDICAMENTS IN A CLEAN ZONE.....	86
3.3. KEEP CONTAMINATED INSTRUMENTS AND EQUIPMENT IN CONTAMINATED ZONE.....	87
<b>SELF-CHECK-3 .....</b>	<b>87</b>
<b>UNIT FOUR: CLEAN ENVIRONMENTAL SURFACES .....</b>	<b>89</b>
4.1. DEFINITIONS OF KEY TERMS.....	90
4.2. GENERAL PRINCIPLES FOR CLEANING.....	91
4.3. WEARING PERSONAL PROTECTIVE EQUIPMENT (PPE).....	91
4.4. REMOVE DUST, DIRT AND PHYSICAL DEBRIS FROM WORK SURFACES .....	93
4.5. CLEANING WORK SURFACES .....	93
4.6. DRYING WORK SURFACES.....	95
4.7. REPLACE SURFACE COVERS.....	96
4.8. MAINTAINING AND STORING EQUIPMENT .....	97
<b>SELF-CHECK-4 .....</b>	<b>99</b>

<b>UNIT FIVE: ASSESS AND CONTROL RISK AND HAZARD .....</b>	<b>100</b>
5.1. DEVELOP ORGANIZATIONAL PROCEDURES FOR HAZARD IDENTIFICATION AND CONTROL OF RISKS. 101	
5.2. IDENTIFICATION OF ALL HAZARDS AT THE PLANNING, DESIGN AND EVALUATION STAGES .....	105
5.3. DEVELOPING AND MAINTAINING HAZARD RISK CONTROL MEASURES .....	108
5.4. IDENTIFYING INADEQUACIES IN EXISTING RISK CONTROL MEASURES .....	111
5.5. PROTOCOLS FOR CARE FOLLOWING EXPOSURE TO BLOOD OR OTHER BODY FLUIDS .....	112
<b>SELF-CHECK-5 .....</b>	<b>118</b>
<b>UNIT SIX: ESTABLISH AND MAINTAIN PARTICIPATIVE MEASURES.....</b>	<b>119</b>
6.1. PARTICIPATIVE PROCESSES IN ACCORDANCE OHS LEGISLATION, REGULATIONS, AND STANDARDS ...	120
6.2. PARTICIPATIVE ARRANGEMENT.....	120
6.3. DEALING WITH ISSUES OF PARTICIPATION AND CONSULTATION .....	121
6.4. DEALING WITH ISSUE WITH CONSULTATION.....	122
6.5. EMPLOYEE ENGAGEMENT .....	122
6.6. PROVIDING INFORMATION ABOUT THE OUTCOMES OF PARTICIPATION AND CONSULTATION .....	123
6.7. ESTABLISH AND MONITORING SYSTEMS FOR KEEPING OHS RECORDS.....	125
<b>SELF-CHECK-5 .....</b>	<b>130</b>
<b>REFERENCES.....</b>	<b>131</b>

## Acronyms

IPC	Infection prevention and control
HAIs	Health acquired infection
PPE	Personal protective equipment
SOP	Standard operation procedure
HLD	High level disinfection
HCWs	Health Care workers
HBV	Hepatitis B virus
HCV	Hepatitis C virus
OHS	Occupational health and safety
HIV	Human immune virus
WHO	World health Organization
OPA	Orthophthalaldehyde
IUS	Immediate use sterilizers

## Introduction

One of the main challenges of health care service is transmission of infectious disease from health care providers to clients and vice versa as well as from health care environment to the providers, clients and the community. This module contains materials that address prevention of infection in the health care system and Occupational health and safety. Transmission of infection across the health care facility controlled by adhering standard precautions, proper hand washing, instrumental processing, using of appropriate personal protective equipment, proper waste disposal methods and cleansing of work environment. It also address hazard and risk control in work place to maintain Occupational Health Safety.

Page 5 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

## Module units

- Identify causes of diseases
- Apply infection prevention techniques
- Limit Contamination
- Clean environmental surfaces
- Assess and control risks and hazards
- Establish and maintain participative arrangements

## Learning objectives of the Module

At the end of this session, the students will able to:

- Identify infectious agents and basic components of disease transmission.
- Apply infection prevention techniques by following universal and standard precaution, instrumental processing, proper waste management, by using personal protective materials and by proper hand washing techniques.
- Keep clean materials in clean zone and contaminated materials in contaminated zone
- Conduct proper cleansing of work environmental using proper cleaning solution.
- Assess and control risk and hazard in the work place.
- Apply appropriate participative processes and Keeping OHS records

## Unit one: Identify Causes of Disease

This learning unit is developed to provide the trainees the necessary information regarding the following content coverage and topics:

- Causes of Infectious disease
- Infection cycle/chain

This unit will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Define terms
- Identify causes of infectious disease
- Explain basic components of disease transmission cycle/infecting

### Learning Instruction

- Read the specific objectives of this Learning Guide
- Read the information written in the information
- Accomplish the “Self-check 1”

## 1.1. Causes of Infections Disease

### 1.1.1. Definition of terms

- **Microorganisms:** causative agents of infection
- **Infectious Microorganisms:** microorganism capable of producing disease in appropriate hosts.
- **Colonization:** presence and multiplication of a microorganisms without tissue invasion or damage.
- **Infection:** colonizing organisms are now causing Cellular response.
- **Infection prevention and control:** a systemic effort or process of placing protective barriers (physical, chemical, or mechanical) between susceptible host & microorganism “used interchangeably with Infection Prevention in this training.”
- **Disease:** any deviation from being health or interruption of the normal structure or function of any body part manifesting by signs and symptoms.
- **Protective Barriers:** are physical, mechanical or chemical processes that prevent the spread of infectious microorganisms from person to person.
- **Nosocomial infections:** Infection arising > 48 hours after admission. Used interchangeably with “healthcare facility acquired infection” or “healthcare associated infections (HAIs)”.
- **Patient Safety:** the reduction and mitigation of unsafe acts within the healthcare system as well as through the use of best practices.
- **Protective Barriers:** are physical, mechanical or chemical processes that prevent the spread of infectious microorganisms from person to person.
- **Contagious disease:** a disease that is transmitted through contact.
- **Communicable Disease:** an illness due to a specific infectious agent or toxic product that arises through transmission from a reservoir to a susceptible host either directly or indirectly
- **Infestation:** lodgment, development and reproduction of arthropods on the surface body and cloth.
- **Host:** the person or animal that affords subsistence or lodgment to an infectious agent



- **Incubation period:** The time interval between invasion by infectious agent and appearance of first sign or symptom.
- **Communicable period:** time for an infectious agent to be transferred from infected to others.
- **Secondary attack rate:** the number of persons developing diseases within the incubation period following exposure to primary case.
- **Micro-Organisms:** A microorganism is any living organism like bacteria, protozoa, or even fungi that cannot be seen with the naked eye.

### 1.1.2. Causes of infection

A basic knowledge of the microscopic organisms that commonly cause infections is important in the day-to-day work of the infection prevention infection (IPC) team. the common disease causing microorganisms are bacteria, viruses, fungi, protozoa and parasites

#### Features of Microorganisms'

- Microscopic size
- Rapid rate of reproduction
- Tendency to spread from one place to another
- Ability to resist eradication

An infection usually causes clinically apparent symptoms or sometimes may cause no symptoms and be subclinical. Symptoms vary according to the type of microorganism and the location of the infection.

#### Sources of Microorganisms in the health care facilities

- The patient (endogenous):
- Another person (exogenous cross-infection)
- The health care environment

#### Characteristics of Microorganisms Commonly Associated with Health Care-Associated Infections (HAIs)

- Are able to survive on the hands of HCWs
- Can survive dryness, heat, and disinfectants
- Live in blood and body fluids

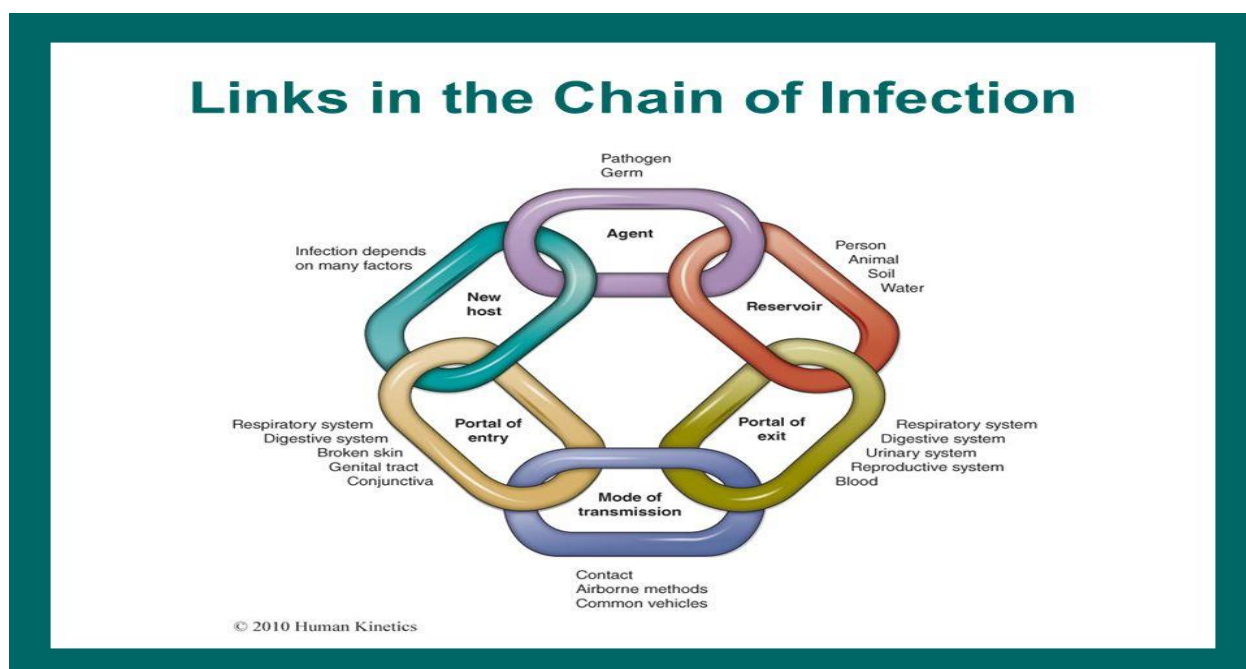
Page 9 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
---------------	--	---------------------------------------	---------------------------

- Thrive in damp areas

## 1.2. Infection cycle/chain

Transmission of infection is a process in which several events happen one after the other in the form of a chain. Hence, this process is known as a chain of transmission. Six major factors can be identified:

- The infectious agent
- The reservoir
- The route of exit
- The mode of transmission
- The route of entry and
- The susceptible host



**Figure 1.1. Components of infection chain/cycle**

**A. Infectious Agents:** Infectious agents can have varying sizes. Some, such as Plasmodium falciparum and all bacteria and viruses, are tiny and are called micro-organisms, because they can only be seen with the aid of microscopes. Others, such as the ascaris worm can be easily seen with the naked eye. The following are the common Infectious agent

- Protozoa**
- Bacteria**

Page 10 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- **Viruses**
- **Other types of infectious agents include fungi and parasite**

- B. Reservoirs:** This refers to any environment, in which infective agents can live, parasitizes and breed. It includes infected human (e.g., patients, carriers and people with latent infections), livestock, insects and soil. The source of infection will normally form the basis for the infective agents to infect humans
- C. Portals Entry:** Successful transmission of the infectious agent requires it to enter the host through a specific part of the body before it can cause disease. The mechanism of entry of infectious organism in Host.
- Through oral cavity and gastro intestinal tract
  - Through respiratory system
  - By insect bite
  - Parenteral transmission
- D. Portals of Exit:** Common portals of exit include respiratory secretions, vaginal secretions, semen, saliva, lesion exudates, blood, and feces.
- E. Modes of Transmission:** Modes of transmission are of two types: direct or indirect.
- **Direct transmission:** implies the immediate transfer of an infectious agent from an infected host or reservoir to an appropriate portal of entry in the human host through physical contact such as touching, biting, kissing, or sexual contact, or through droplet spray and transplacental transmission
  - **Indirect transmission:** is the spread of infection through a vehicle of transmission outside the host. These may be.
    - ✓ Vector-borne transmission (houseflies, mosquitoes, lice and ticks)
    - ✓ Vehicle-borne transmission (non-living substance or object that can be contaminated by an infectious agent).
- F. Host Susceptibility:** Individuals who are likely to develop a communicable disease after exposure to the infectious agents are called susceptible hosts. Not all humans are equally susceptible for contracting an infection. It depends on different factors

### Breaking the chain/cycle of infection

Page 11 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

Understanding the Chain of Infection or Transmission Cycle of specific infectious diseases is important, if healthcare workers are to:

- Prevent transmission of microorganisms
  - ✓ From patient to patient,
  - ✓ From patient to the provider or vice versa during medical and surgical procedures;
- Teach others on the factors required for transmission to occur and most importantly.
- Teach others on how to break the disease transmission cycle;

Preventing the spread of infectious agents or proper infection prevention and control practice requires breaking the chain of infection by removing one or more of the conditions necessary through practices which;

- Reduce the number of microorganisms present (e.g. hand washing, cleaning of instruments)
- Kill, inhibit or inactivate microorganisms (e.g. hand washing with a waterless alcohol preparation, decontamination of patient care items);
- Create barriers to prevent infectious agents from spreading (e.g. wearing gloves or personal protective equipment); or
- Reduce or eliminate risky practices (e.g. by using hands-free technique in the operation room, using gloves and disposable syringes etc.)
- Make sure that people, especially healthcare workers, are immune or vaccinated

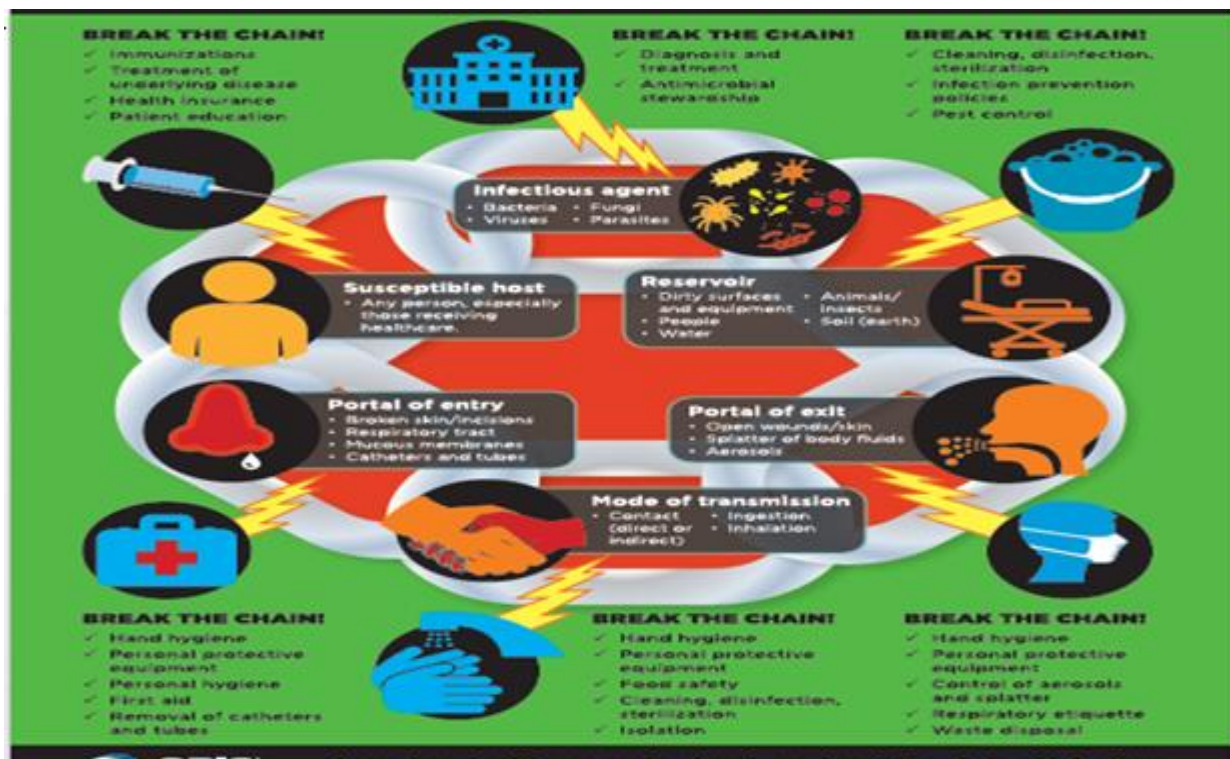


Figure I.2. Break the chain of infection

## Self-check-1

**Directions:** Answer all the questions listed below.

Part I: write “True” if the statement is correct or “False” if the statement is incorrect

1. Disease is colonizing organisms are now causing Cellular response.
2. Indirect transmission of infection is the spread of infection through a vehicle of transmission outside the host.

Part II: choose the correct answer among the alternatives for the following multiple chose questions

1. Which is **NOT** the features of microorganisms
  - A. Microscopic size
  - B. Rapid rate of reproduction
  - C. Tendency to spread from one place to another
  - D. Ability to resist eradication
2. \_\_\_\_\_ refers to any environment, in which infective agents can live, parasitizes and breed.
  - A. The infectious agent
  - B. The reservoir The route of exit
  - C. The mode of transmission
  - D. The route of entry and

**Part III: write correct and short answer for the following essay item questions**

1. List the characteristics of microorganisms Commonly Associated with Health Care- Associated Infections (HAIs).
2. Discus about the infection cycle/chain of
  - A. HIV/AIDS
  - B. Covid 19

## Unit Two: Apply infection prevention techniques

This learning unit is developed to provide the trainees the necessary information regarding the following content coverage and topics:

- Elements of infection prevention
- Standard precaution
- Transmission based precaution
- Instrument processing
- Infectious waste management
- Personal protective equipment
- Hand washing

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify elements of infection prevention.
- Explain components of standard precaution.
- Identify types of transmission based precaution
- Perform instrumental processing
- Place infectious waste in the correct waste bean
- Use personal protective equipment
- Perform appropriate hand washing technique

### Learning Instruction

- ✓ Read the specific objectives of this Learning Guide.
- ✓ Read the information written in the information
- ✓ Accomplish the “Self-check I”

## 2.1. Essential elements of infection prevention

According the 1991 New York city legislation there are seven elements of elements of infection prevention. The seven elements are spelled out in the following box and then explained in the sections that follow.

1. Element I: Scientifically Accepted Principles
2. Element II: Mechanism of Transmission
3. Element III Engineering and Work Practice Controls
4. Element IV: Personal Protective Equipment
5. Element V: Cleaning, Disinfection, and Sterilization
6. Element VI: Protecting Healthcare Workers
7. Element VII: Sepsis Awareness and Education

### 1. Scientifically Accepted Principles

The responsibility to adhere to scientifically accepted principles and practices of infection control and to monitor the performance of those for whom the professional is responsible. Scientific evidence is the primary source of guidance for infection control practice and, as the science has evolved, practices have been updated to reflect new findings. A number of factors contribute to this changing landscape; for example, germs evolve and mutate, and new diseases emerge.

### 2. Mechanism of Transmission

Modes and mechanisms of transmission of pathogens organisms in the healthcare setting and strategies for prevention and control. It is becoming increasingly clear that transmission of infections in health care settings are largely preventable through the use of evidence-based IC guidelines. The concept of the chain of infection provides the basis for understanding the transmission of pathogens as well as identifying practices and procedures to prevent healthcare-associated infections.

### 3. Engineering and Work Practice Controls

The use of engineering and work practice controls to reduce the opportunity for patient and healthcare worker exposure to potentially infectious material should be standard practice in all healthcare settings, not only in hospitals.

- **Engineering controls** such as sharps disposal containers, self-sheathing needles, and safer medical devices.

Page 16 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
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- **Work practice controls** reduce the likelihood of exposure by altering the manner in which a task is performed (e.g., prohibiting recapping of needles by a two-handed technique).
- Percutaneous (through the skin) exposures can occur during handling, disassembly, disposal, and reprocessing of contaminated needles and other sharp objects.
- Mucous membrane/non-intact skin exposures occur when there is direct blood or body fluids contact with the eyes, nose, mouth, or other mucous membranes.
- Parenteral refers to a route of transmission or administration that involves piercing mucous membranes or the skin barrier through such events as needle sticks, human bites, cuts, and abrasions.

#### 4. Personal Protective Equipment

Selection and use of barriers and/or personal protective equipment for preventing patient and healthcare worker contact with potentially infectious material. Personal protective equipment (PPE) includes barriers such as gloves, gowns, masks, goggles, and face shields. They protect patients and workers from exposure to blood borne pathogens on the job.

#### 5. Cleaning, Disinfection, and Sterilization

Creation and maintenance of a safe environment for patient care in all healthcare settings through application of infection control principles and practices for cleaning, disinfection, and sterilization.

#### 6. Protecting Healthcare Workers

Healthcare personnel are all paid and unpaid persons working in healthcare settings who have the potential for exposure to infectious materials, including body substances, contaminated medical supplies and equipment, contaminated environmental surfaces, or contaminated air.

#### 7. Sepsis Awareness and Education

Application of accepted infection control principles helps maintain a safe environment for both patients and healthcare workers. This includes proper use of Standard Precautions and an understanding and ability to apply proper techniques for cleaning, disinfection, sterilization, and reprocessing of medical equipment.

Page 17 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

## 2.2. Standard precaution

These are set of guidelines designed to create physical, chemical and mechanical protective barrier between microorganism and person to prevent the spread of infection (the barrier serves to break the diseases transmission cycle). Example of barriers

- Physical- Personal protective equipment (PPE)
- Mechanical barrier – high level disinfection (HLD) and Sterilization
- Chemical- Antiseptic and Disinfectant

Standard Precaution is first level precautions. The aim of standard precautions is to reduce the risk of transmitting micro microorganisms form known or unknown source infection within health care settings. Applying Standard Precaution while providing patient care is based on the anticipated interaction health work worker (HCW) will have with patient. They provide a rationale for appropriate utilization of limited infection prevention and control (IPC) resources.

### Key Principles of Standard Precaution

- Consider every client and patient as potentially infectious or susceptible to infection.
- Apply to all patients and clients attending health care facility
- Apply to all blood, body fluid, secretion, excretion (except sweat), mucous membrane and no intact skin.

### Key Components of Standard Precautions

The components of Standard Precautions create protective barriers for preventing infections in visitors, patients, and HCWs and are based upon the premise that every person (patient, visitor, or HCW) is potentially infectious and susceptible to infection. the components are listed and explained below.

#### Hand Hygiene

- After touching blood, body fluids, secretions, excretions and contaminated items;
- Immediately after removing gloves;
- Between patient contacts

#### Wearing Gloves

- For contact with blood, body fluids, secretions/excretions or contaminated items;
- For contact with mucous membranes and non-intact skin

#### Gowns/Aprons

Page 18 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
----------------	--	---------------------------------------	---------------------------

- Protect skin from blood or body fluid contact
- Prevent soiling of clothing during procedures that may involve contact with blood or any body fluids (secretions/excretions)

### **Masks, Goggles and Face shields**

- Protect mucous membranes of eyes, nose and mouth when contact with blood and body fluids is likely or possible

### **Sharps and Injection Safety**

- Avoid recapping, bending, breaking, or hand manipulate used needles; use a one-handed scoop technique only if needed;
- Avoid removing used needles from disposable syringes
- Place used sharps in puncture-resistant container at point of use

### **Processing textile and Laundry**

- Handle soiled linen to prevent touching of skin or mucous membrane
- Do not pre-rinse soiled linens in patient care areas

### **Healthcare waste Management**

- Safely dispose of infectious waste materials to protect those who handle them and prevent injury or spread of infection to the community.
- HCWM is a key issue to control and reduce HAIs in healthcare facilities (HCF) and to ensure that the environment is well protected.

### **Environmental Cleaning**

- Routinely clean noncritical care equipment, instruments, devices, and environmental surfaces.
- Clean patient care equipment between each use on patients to prevent cross-contamination between patients.

### **Safe practice in the OR**

- Use safe zone ( hand free techniques to pass and receive sharps in the OR)
- Use proper handling of sharps

### **Instrument Processing**

Page 19 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- Special attention should be given to proper handling of the instruments and other items to minimize the risk of accidental injury or exposure to blood and other body fluids of the sterile processing staff and to attain high quality end result.

## 2.3. Transmission Based Precaution

Are guidelines designed to reduce the risk of transmitting infections that are spread wholly or partly by airborne, droplet, or contact routes between hospitalized patients and health providers. Transmission-Based Precautions are for patients who are known or suspected to be infected or colonized with infectious agents including epidemiologically important pathogens which require additional control measures to effectively prevent transmission. Since the infective agent is not often known at the time of admission to a healthcare facility, Transmission-Based Precautions are used empirically according to the clinical syndrome and the likely etiologic agents at the time. Later, the course of management should be modified as soon as the pathogen is identified or a transmissible infectious etiology is ruled out.

### Key Components of Transmission-Based Precaution

Key components of transmission based precaution are

- I. Airborne precaution
- II. Droplet precaution
- III. Contact precaution

### Examples

- Airborne: Chicken pox , measles, and tuberculosis
- Droplet: Mumps, rubella, and meningitis (N. meningitides)
- Contact: Enteric pathogens (hepatitis A, echo viruses) and herpes simplex

For some diseases that have multiple routes of transmission, more than one Transmission-Based Precautions category may be used. When used either individually or in combination, each routes of transmission based precautions are always used in addition to Standard Precautions. When Transmission-Based Precautions are indicated, efforts must be made to counteract possible adverse effects on patients.

Page 20 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

## I. Airborne precaution

Prevent transmission of infectious agents that remain infectious over long distances (particles which are 5µm or less in size and can remain in the air for several hours and be widely dispersed). They are recommended for patients with either known or suspected infections that could be transmitted by airborne route.

### Characteristics

- Particles which are 5µm or less in size and can remain in the air for several hours and be widely dispersed.
- Transmission can occur either through airborne droplet nuclei or dust particles containing the infectious microorganisms.
- Produced by coughing, sneezing, talking, or by procedures (e.g., bronchoscopy or suctioning).
- Special air handling and ventilation are needed to ensure prevention of airborne transmission of infectious agents.
- Airborne particles do not land on and contaminate surfaces.

### Patient Placemat

- Patients should be placed in airborne infection isolation room (AIIR).
- An AIIR is a single-patient room that is equipped with special air handling and ventilation capacity.
- If private room not available, place patients in a room with patient having active infection with the same disease, but with no other infection (cohorting).
- The staff on duty should check all visitors for susceptibility before allowing them to visit.
- Limit movements in and out of the room to HCWs caring for the patient.

### Respiratory Hygiene and Cough Etiquette

- Cover the mouth and nose when coughing and sneezing and dispose of used tissues in the nearest waste container.
- Perform hand hygiene after contact with respiratory secretions and contaminated objects.
- Maintain an appropriate distance from and between symptomatic patients, at least 1 meter (3 feet).

Page 21 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- Identify persons with symptoms suggestive of acute respiratory illness and teach them to use a surgical mask and practice cough etiquette.

### Use of PPE

- Wear a particulate respirator such as a fit-tested N95, and conduct a seal check before entering the patient's room.
- In case of chickenpox or measles, no mask is needed for immune persons but susceptible persons should not be allowed to enter the room.
- Remove respirator or surgical mask after leaving the room and place in a plastic bag or waste container with tight-fitting lid.
- Gown, gloves, and eye protection are not needed for many organisms transmitted exclusively by the airborne route (such as M. tuberculosis, measles) but may be needed when an infectious microorganism is transmitted by multiple routes (e.g., varicella virus).

### Patient Transport

- Limit transport of patient to essential reasons only.
- Alert the department or facility where the patient is being transported so they can prepare to receive a patient on Transmission-Based Precautions.
- Use PPE appropriately
  - ✓ Patients wear a surgical mask
  - ✓ Cover wounds with appropriate dressings
  - ✓ Clean and disinfect the wheelchair or coach after transportation.
  - ✓ Remove PPE and perform hand hygiene

## II. Droplet Precautions

Reduce the risks of transmission of pathogens spread wholly or partly by droplets larger than 5µm in size (e.g. Bordetella pertussis, H. influenza & N. Meningitides, M. pneumonia, flu, mumps, and rubella viruses). Other conditions include Diphtheria, Pertussis, Pneumonic Plague and S. pharyngitis.

### Characteristics

- Transmission of pathogens spread wholly or partly by droplets larger than 5µm in size.
- Remain in the air briefly and can travel about 1 meter (3 feet) or less.

Page 22 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
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- Requires close proximity or contact between the source and the susceptible host.
- Droplets may also land on surfaces and then be transferred by contact transmission.

### **Patient Placement**

- Private room, door may be left open.
- Patients should wear a surgical mask in waiting rooms and when outside of the patient room.
- If private room is not available, place the patient in a room with patient having active infection with the same disease, not with other infection.
- If neither option is available, maintain over 1 meter (3 feet) spatial separation between patient beds and use of a physical barrier, such as a curtain or divider.

### **Patient Transport**

- Limit transport of patient to essential reasons only.
- Alert the department or facility where the patient is being transported so they can prepare to receive a patient on Transmission-Based Precautions.
- Use PPE appropriately
  - ✓ Patients wear a surgical mask
  - ✓ Cover wounds with appropriate dressings
  - ✓ Clean and disinfect the wheelchair or coach after transportation.
  - ✓ Remove PPE and perform hand hygiene

### **Respiratory Hygiene and Cough Etiquette**

- Cover the mouth and nose when coughing and sneezing and dispose of used tissues in the nearest waste container.
- Perform hand hygiene after contact with respiratory secretions and contaminated objects.
- Maintain an appropriate distance from and between symptomatic patients, at least 1 meter (3 feet).
- Identify persons with symptoms suggestive of acute respiratory illness and teach them to use a surgical mask and practice cough etiquette.

## Use of PPE

- Wear eye protection and a face mask or face shield, which cover eyes, nose, and mouth completely, before entry into the patient care area
- Remove PPE after leaving the patient care area.
- If PPE is to be re-used, it must be cleaned and disinfected before each reuse.
- Always perform hand hygiene before and immediately after patient care.

## Cleaning

- Ensure that rooms of patients on Droplet Precautions are frequently cleaned and
- Disinfected (at least daily and prior to use by another patient). Focus cleaning on surfaces, frequently touched items, and equipment in the immediate patient area
- Use gloves, gown and face/eye protection when cleaning patient care equipment and the environment of a patient who has been on Contact Precautions.

## III. Contact Precaution

Patients are placed on Contact Precautions when they have **suspected or known infections** that are **spread directly or indirectly** from an infected or colonized individual **by touch or contact** with the patient or the patient's environment (surfaces and equipment). Organisms that require Contact Precautions include cholera, varicella-zoster (shingles); neonatal or mucocutaneous herpes simplex virus; enterovirus meningitis; patients infected or colonized with enteric pathogens, hemorrhagic fever viruses, multidrug-resistant organisms such as and carbapenem-resistant Enterobacteriaceae (CRE); and C. difficile.

Chicken pox is spread both by the airborne and contact routes at different stages of illness. Contact precautions should be implemented for patient with wet or draining infection that may be contagious (e.g. draining abscesses, herpes zoster, impetigo, conjunctivitis, scabies, lice and wound infection).

## Characteristics

- Infectious agent transmitted directly from one infected or colonized person to a susceptible person.
- Contact is a common way that germs spread in health care facilities.

Page 24 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022



- Infectious agent transmitted indirectly from contaminated inanimate object (e.g., toilet seat, door handle or soiled (feces) bed linen.
- Transfer often from hands of health worker (cross-contamination)

### **Patient Placement**

- Isolate patients who require Contact Precautions in a single room, if possible.
- The door may be left open in this case.
- If private room is not available, place the patient in a room with patient having active infection with the same microorganism, not with other infections (cohorting).
- In multi-patient rooms, more than one meter (3 feet) spatial separation between patient beds is advised to reduce the opportunities for inadvertent sharing of items between the infected/colonized patient and other patients.

### **Use of PPE**

- Put on a clean, non-sterile gown and gloves upon entering the patient care area; remove and properly discard before exiting the patient room.
- Perform hand hygiene immediately after removing PPE For semi-private or multi-patient rooms, do not use the same PPE between patients.
- Remove PPE, perform hand hygiene, and put on new PPE before coming in contact with another patient or patient environment (e.g., bed, patient locker, over-bed table, IV stand etc.).

### **Hand washing**

- Involves HCWs cleaning their hands before, after, and at specific moments during patient care and when performing health care tasks.
- Wash hands with antimicrobial agent, or use alcohol hand rub before entering room and after removing gloves (if patient has C. difficile diarrhea, need to wash hands with soap and water after removing gloves).
- Do not touch potentially contaminated surfaces or items before leaving the room.

## Patient Transport

- Limit transport of patients to essential purposes only.
- During transport, ensure precautions that are maintained to minimize risk of transmission of organisms (i.e. cover patient with clean linen not what was used on patients' bed).

## Patient care equipment

- Use disposable or dedicated patient care equipment (e.g., blood pressure cuffs) and clean and disinfect equipment before reuse on other patients.

## Cleaning

- Ensure that rooms of patients on Contact Precautions are frequently cleaned and disinfected (at least daily and prior to use by another patient). Focus cleaning on toilets, frequently touched surfaces, and equipment in the immediate patient area.
- Use gloves and gown when cleaning patient care equipment and the environment of a patient who has been on Contact Precautions.
- Organisms that form spores (such as norovirus and *C. difficile*) require cleaning products, such as bleach, that inactivate spores, which are more difficult to destroy than vegetative microorganisms.

## Empiric/ Syndromic Use of Transmission Based Precaution

Every effort should be made to diagnose the microorganism responsible for infection; however, laboratory diagnosis is not immediately available and not always available. In these circumstances, precautions must be based on empiric/syndromic findings. If there is any question about whether a patient without a known diagnosis has a specific infection, implement Transmission-Based Precautions based on the patient's signs and symptoms until a definitive diagnosis (i.e., laboratory test results) can be made.

## Airborne

- Cough, fever, and upper lobe chest findings (dullness and decreased breath sounds)
- Cough, fever, and chest findings in an HIV infected person or person at high-risk for HIV
- Rashes (vesicles or pustules) suggestive varicella

Page 26 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- Acute respiratory distress syndrome

### **Droplet**

- Severe, persistent cough during periods when pertussis is present in the community
- Meningitis (fever, vomiting, and stiff neck)
- Hemorrhagic rash with fever
- Generalized rash of unknown cause

### **Contact**

- Acute diarrhea in an incontinent or diapered patient
- Diarrhea in adult with recent antibiotic use
- Bronchitis or croup in infants and young children
- History of infection with multi drug resistant organisms
- Abscess or draining wound that cannot be covered

## **2.4. Instrument processing**

Instruments which are reused without being properly processed and made safe are one of the causes of infections in developing countries. Healthcare workers are increasingly at risk of becoming infected with serious blood borne viruses such as hepatitis B virus (HBV), (HCV) and human immune virus (HIV). The basic infection prevention processes recommended to reduce disease transmission from soiled instruments; surgical gloves and other reusable items are by way of cleaning and either sterilization or high-level disinfection (HLD). In all steps, special attention should be given to proper handling of the instruments and other items to minimize the risk of accidental injury or exposure to blood and other body fluids of the sterile processing staff and to attain high quality end result.

### **Spaulding's category of potential infection risk**

Spaulding classified instruments and patient care devices into three categories, based upon how the device is used. Items are classified as:

- **Non-critical**—come in contact with intact skin but not mucous membranes
- **Semi-critical**—come in contact with mucous membranes or non-intact skin
- **Critical**—come in contact with sterile areas of the body including the vascular system

Page 27 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

Table 2.1. Spaulding's category of potential infection risk and the level of disinfection/sterilization

Risk category	Level of disinfection/sterilization	Examples
Critical	Sterilization	Reusable surgical instruments
Semi-critical	High-level disinfection	Respiratory instruments, specula used for vaginal examination ,endoscopes
Critical	Cleansing	Blood pressure cuffs, stethoscopes

### Work flow for instrument processing and other medical devices

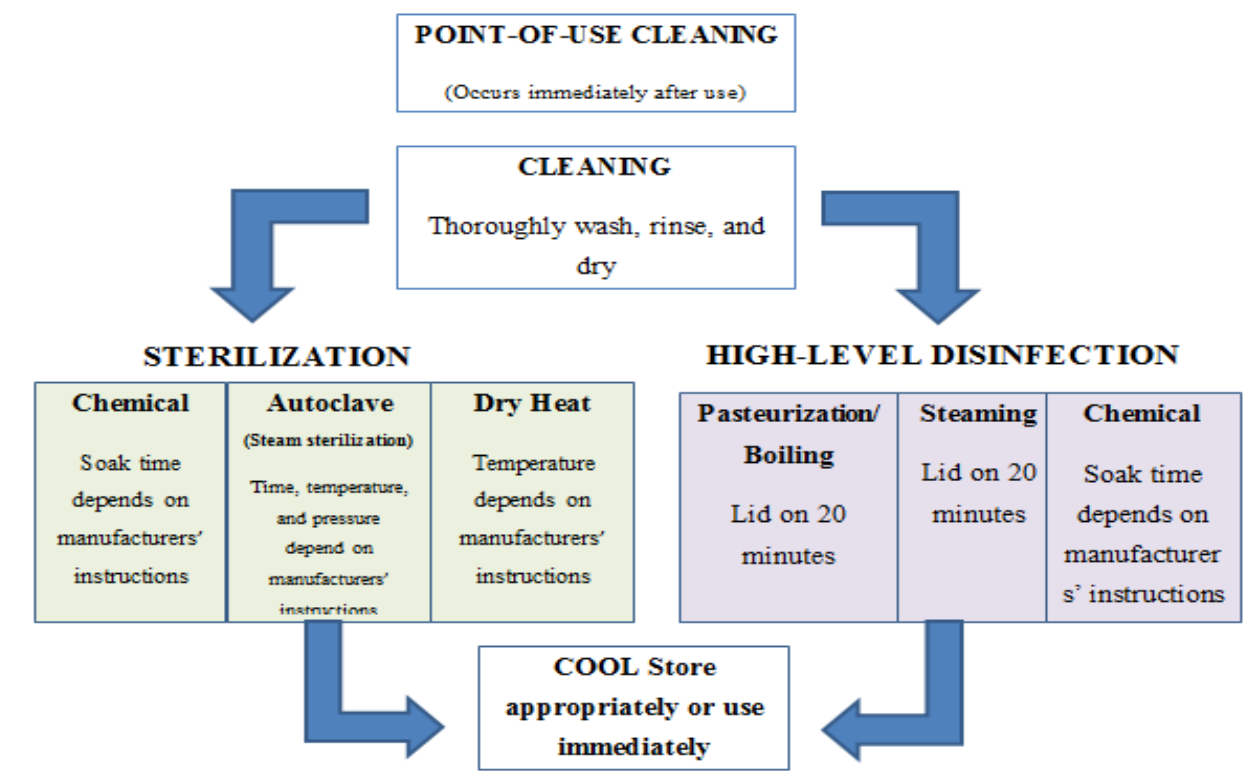


Figure 2.1. Work flow for instrument processing and other medical devices

### Soaking of instruments in disinfectant prior to cleaning

According to the WHO, soaking of instruments in 0.5% chlorine solution or any other disinfectant prior to cleaning is not recommended for the following reasons:

- It may damage/corrode the instruments

- The disinfectant may be inactivated by blood and body fluids, which could become a source of microbial contamination and formation of biofilm. Transportation of contaminated items soaked in chemical disinfectant to the decontamination area may pose a risk to health care workers and result in inappropriate handling and accidental damage. May contribute to the development of antimicrobial resistance to disinfectants.

## Introduction to Chemical Disinfectants

Disinfectants are chemicals that destroy or inactivate microorganisms in inanimate objects.

Commonly Used Chemical Disinfectants are;

- Alcohols
- Chlorine and chlorine releasing compounds
  - ✓ Sodium hypochlorite (Chlorine bleach)
  - ✓ Calcium hypochlorite or chlorinated lime
  - ✓ Sodium dichloroisocyanurate
- Glutaraldehyde
- Formaldehyde
- Iodine and iodophor solutions
- Hydrogen Peroxide
- Orthophthalaldehyde (OPA)

## Properties of an Ideal Disinfectant

- Wide antimicrobial spectrum
- Rapidly kills microorganisms
- Active in the presence of organic matter and compatible with soaps, detergents, and other chemicals encountered in use
- Non-toxic
- Does not cause the deterioration of cloth, rubber, plastics, and other materials.
- Easy to use with clear label instructions
- Pleasant odor or no odor to facilitate its routine use
- Not prohibitively high in cost

Page 29 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- Soluble in water
- Stable in concentrate and at use-dilution
- Good cleaning properties
- Environmentally friendly on disposal

**2.4.1. Cleaning :** Cleaning is a process of physically removing infectious agents and other organic matters on which they live and thrive but does not necessarily destroy infectious agents. It is an essential pre-requisite to ensure effective disinfection or sterilization by reducing the number of microorganisms, especially endospores causing tetanus. Cleaning is the first and a critical step in reprocessing a device after use.

- It reduces damage to instruments.
- It makes instruments easier to process.
- One can clean without sterilizing, but one cannot sterilize without cleaning!

If instruments are not properly cleaned:

- Bio burden and residual cleaning agents remaining on an item can inactivate chemical disinfectants or sterility and protect microorganisms from destruction, which can result in disinfection and sterilization failures.
- And also instruments and materials used during an operation that are covered with blood and tissue remains may also have been in touch also with chemicals and fluids, dirt and dust.
- Hinged instruments may have remnants of blood and tissue from the operation. The tubing of hollow instruments may be also full of these soiled materials.

Therefore, it is important to follow all the necessary steps to properly clean instruments prior to high-level disinfection or sterilization.

Table 2.2. Effectiveness of Methods of Processing Instruments

Method	Effectiveness (kill or remove microorganisms)	End point
Cleaning (soap and rinsing with water)	Up to 80%	Until visibly clean
High-Level Disinfection	95% (does not inactivate endospores)	Boiling or chemical for 20 minutes
Sterilization	100%	High-pressure steam, dry heat for the recommended time

### Steps of manual cleaning:

- Put on Personal Protective Equipment (PPE) including a water resistant gown, gloves, face mask and head cover.
  - ✓ If gloves are torn or damaged, they should be discarded; otherwise, they should be cleaned and left to dry for re-use in the following day.
  - ✓ Even when wearing heavy-duty utility gloves, care should be taken to prevent needle sticks or cuts when washing sharps.
- Fill sink or appropriate basin with sufficient warm water for complete immersion of the devices being cleaned.
- Add the appropriate quantity of detergent following the manufacturer's instructions for dosage.
- Clean the device under the surface of the water so that aerosols are not produced.
- All devices be disassembled so that all surfaces may be cleaned and disinfected, irrespective of the cleaning method chose.
- Use appropriate brushes to properly clean box locks, lumens and other hard-to-clean areas
  - ✓ Use soft (nylon) bristle brushes so that the surface of the instrument is not damaged.
  - ✓ Brushes used to clean lumens must be the same diameter as the instrument to ensure that all internal surfaces can be reached.
  - ✓ Brushes must also be long enough to exit the distal end of the instrument
  - ✓ Brushes should be thermally or chemically disinfected at the end of the day, if this is not possible, they should be cleaned and left to dry.

- ✓ Brushes should be replaced when damaged.
- In another sink or basin, completely immerse the device in clean purified water and rinse the device thoroughly.
- Air-dry or hand-dry using a disposable clean, non-linting cloth.
- Items that cannot be cleaned thoroughly should not be reused, but be discarded after use.

## Cleaning Products and their properties

There is no single cleaning agent that removes all types of bio-burden. Bio-burden is made up of a variety of matter, which may be soluble or insoluble in water and can be organic or inorganic. The properties associated with ideal cleaning agents: Emulsification, Surfactation, Dispersion and suspension, Water softening, Free rinsing and Non-toxic.

## Selection of cleaning agents

Deposits of dust, soil and microbial residue on equipment can contribute to healthcare-associated infections. Cleaning agents remove organic, inorganic and microbial contaminants. No single compound has all the properties that are required to remove all soil deposits. The first step in cleaning is the use of surfactants or surface-active agents to reduce tension, which assists in soil being held in the cleaning solution.

### 1.4.2. Packing and Wrapping

The inspection, assembly and packaging of reusable surgical instruments and medical devices is a crucial part of the reprocessing cycle. All instruments and other items should be thoroughly cleaned and dried before being disinfected or prepared for sterilization. In some cases, it is not necessary to completely dry the items (needles or the like which have small openings) being sterilized for the small amount of water left inside these openings help in the steam sterilization process. For such items, flushing them with distilled or boiled water just prior to packaging for steam sterilization should be done after cleaning. Finally, **all jointed instruments should be open (or be unlocked) and disassembled**. Reusable cloth items should be laundered and dried after use or prior to sterilization in order to:

- Remove organic matter, and
- Prolong the life of the cloth by restoring the fabric's normal moisture (water) content.

Page 32 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022



## Inspection and function testing (post-cleaning)

- Each set should be inspected separately.
- Box joints, serrations and crevices should be critically inspected for cleanliness.
- Hinges on devices, such as artery forceps and clamps, should be checked for ease of movement.
- Jaws and teeth should be checked for alignment Ratchets should be checked for security.
- Multi-part instruments should be assembled to ensure that all parts are complete and working.
- Multi-part instruments should be assembled or disassembled for sterilization per manufacturers' instructions.
- Any damaged, incomplete or malfunctioning devices should be reported immediately to the supervisor.
- Cutting edges on devices, such as scissors, rongeurs, chisels and curettes, should be checked for sharpness.
- Hinges on devices, such as artery forceps and clamps, should be checked for ease of movement.
- Each device should be checked after each cleaning cycle to ensure that all screws on jointed devices are tight and have not become loose during the cleaning process.

### I. Packing and wrapping for steam sterilization

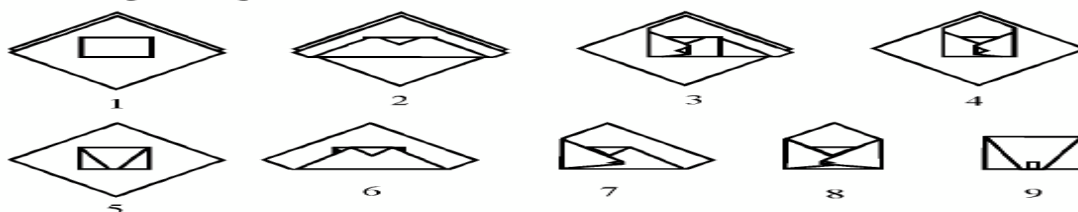
Wrapping items to be sterilized permit sterile items to be handled and stored without being contaminated. Materials used for wrappers should:

- Allow air removal and steam penetration
- Act as a barrier to microorganisms and fluids
- Capable of withstanding high temperatures
- Resist tears and punctures and be free of holes
- Be nontoxic and low-lint
- Not be costly

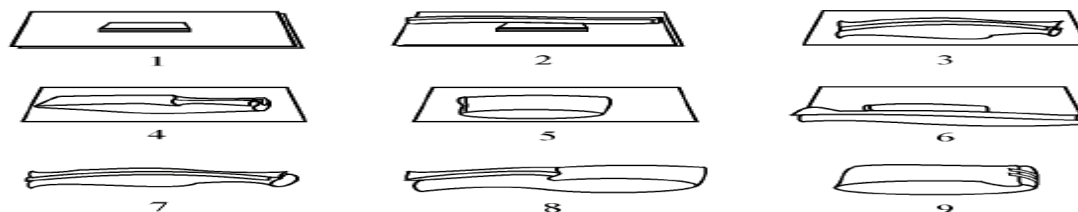
### Typical Wrapping Techniques

Page 33 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
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#### Envelope Wrap



#### Square Wrap



**Table 2.2. techniques of wrapping for stem sterilization**

#### Tips for wrapping

- At least two layers of wrapping should always be used to reduce the possibility of contaminating the contents during unwrapping.
- Do not wrap packages too tightly.
  - ✓ If they are wrapped too tightly, air can become trapped at the center of the packages preventing the temperature from getting high enough to kill all the microorganisms.
  - ✓ Also, wrapping with strings or rubber bands or tying linen too tightly can prevent steam from reaching all surfaces.
- Hemmed strips of about ½ inch wide and of varied lengths., one or two of such strips can be used for each package.
- Because they can fit to almost any size of package, they eliminate the need for an expensive and hard-to-remove indicator tape.
- Tips for wrapping cont'd...
- The outer wrapper of the pack can be loosely secured using linen ties.
- Packs can be secured with linen ties made from the same cloth.

- Do not wrap items in any waterproof material such as plastic or canvas for steam sterilization as the steam cannot penetrate the material and leave the item unsterilized.
- Wrappers should not be reused if they are torn, stained with oils or have hard or gummy deposits.

## II. Packing and wrapping for dry heat sterilization

Packaging materials for dry-heat sterilization should

- Allow easy heat penetration,
- Provide an adequate barrier to microorganisms after sterilization,
- Resist tearing or puncturing before and after sterilization,
- Have proven seal integrity,
- Allow for ease of aseptic presentation,
- Be free of toxic ingredients,
- Be low-linting or lint-free, and
- Be cost-effective and readily available.
- The material should have been approved for use with dry-heat sterilization.

### 2.4.3. High Level Disinfection

Sterilization is the safest and most effective method for the reprocessing of surgical instruments because it kills all vegetative microorganisms and microbial spores. However, sterilization is not always suitable because some materials cannot with-stand the high temperatures used during the sterilization process an sterilization may not be consistently available in some low-resource settings. Per the Spaulding classification, devices that come in contact with intact skin are classified as non-critical items and should be processed by intermediate- or low-level disinfection. Surgical instruments and medical devices that come in contact with non-intact skin or mucous membranes (classified as semi-critical devices) must, at a minimum, be high level disinfected, though sterilization is always preferable when possible. Destroys all microorganisms including HBV, HCV, and HIV; does not reliably kill all bacterial endospores

**High-level disinfection can be achieved by:**

- Pasteurization/ Boiling in water,

Page 35 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
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- Steaming
- Soaking instruments in chemical disinfectants (chemical disinfection).

**Pasteurization** can be used to achieve HLD of instruments and medical devices. It is carried out by heating at  $77^{\circ}\text{C}$  ( $170.6^{\circ}\text{F}$ ) for 30 minutes or boiling at  $100^{\circ}\text{C}$  ( $212^{\circ}\text{F}$ ) for 20 minutes.

**Boiling** has been a common practice for HLD of instruments and equipment used for semi-critical and sometimes critical procedures as it was the only available option in some low-income countries.

**Pasteurization/ Boiling** in water is an effective and practical way to high-level disinfect instruments and other items. Although boiling instruments in water for 20 minutes will kill all vegetative forms of bacteria, viruses (including HBV, HCV and HIV), yeasts and fungi; it will not kill all endospores reliably.

#### Instructions for HLD by boiling

- **STEP 1:** Clean all instruments along with other items to be high level disinfected.
- **STEP 2:** If possible, completely immerse items in the water. Adjust the water level so that there is at least 2.5cm (1 inch) of water above the instruments. Further, make sure that all bowls and containers to be boiled are full of water. For example, one needs to empty bowls that turned bottom side up and float on the surface containing air pockets. Metal instruments should be completely covered with water during boiling.
- **STEP 3:** Close-lid over pan and bring water to a gentle rolling boil. Boiling too vigorously wastes fuel, rapidly evaporates the water and may damage delicate [or sharp] instruments or other items. Hence, a gentle rolling boil is sufficient and will prevent instruments or other items from being bounced around and possibly damaged by striking other instruments or the side walls of the boiling pot.
- **STEP 4:** Start timer. In the HLD log, note time on the clock and record the time when rolling boil begins. Do not add anything to the pot after timing begins.
- **STEP 5:** Boil all items for the required time: 30 minute at  $77^{\circ}\text{C}$  ( $170.6^{\circ}\text{F}$ ) or 20 minutes at  $100^{\circ}\text{C}$  ( $212^{\circ}\text{F}$ ). Always boil for the required time period in a container with a lid. Start timing when the water begins to boil.

- **STEP 6:** Remove all items after the recommended time with a high-level disinfected forceps. Never leave boiled instruments in the water that has stopped boiling. Because, as the water cools and the steam condense, air and dust particles are drawn down into the container and may contaminate those instruments.
- **STEP 7 :** Use instruments and other items immediately or else, pick them up with high-level disinfected forceps or gloves and place objects in a high-level disinfected container with a tight-fitting cover. If any pooled water remains in the bottom of the container, remove the already dried items and place them in another high-level disinfected container that is dry and can be tightly covered.

### High-level disinfection by steaming

High-level disinfection by steaming is an option for plastic items used for patient care. Materials needed for high-level disinfection by steaming include:

- Steamer pan without holes to hold water (such as momo steamer)
- Two to three additional pans with holes to allow steam to move to upper pan
- The pans should be deep enough to fit the largest item being steamed
- A tight-fitting lid to cover the upper pan
- An additional bottom pan for drying the processed items

### Instructions for HLD by steaming

- **STEP 1:** Perform hand hygiene and
- **STEP 2:** Fill the bottom pan of the steamer with approximately 1 liter of clean water – about half the volume of the pan

**STEP 3:** Place instruments, plastic MVA cannula and other items in one of the steamer pans with holes in its bottom. To make removal from the pan easier, do not overfill the pan.

Repeat this process up until three steamer pans have been filled. Stack the filled steamer pans on top of a bottom pan containing water for boiling. A second empty pan without holes should be placed on the counter next to the heat source (**see Step 7**)



**Figure 2.3. Steamer Used for HLD**

- **STEP 4:** Place a lid on the top pan and bring the water to a full rolling boil. It should be noted that when water only simmers, very little steam is formed and the temperature may not get high enough to kill microorganisms.
- **STEP 5:** When steam begins to come out between the pans and the lid, start the timer or note the time on a clock and record the time in the HLD log.
- **STEP 6:** Steam items for 20 minutes.
- **STEP 7:** Remove the top steamer pan and put the lid on the pan that was below it (the pan now on top). Gently shake excess water from the pan just removed.
- **STEP 8:** Put the pan just removed onto the empty pan (see Step 3). Repeat until all pans are restacked on this empty pan and cover the top pan with the lid. This step allows the items to cool and dry without becoming contaminated.
- **STEP 9:** Allow items to dry in the air while in the steamer pans (1 to 2 hours) before using.
- **STEP 10:** Using a high-level disinfected forceps; transfer the dry items to a dry, high-level disinfected container<sup>3</sup> with a tight-fitting cover. Instruments and other items can

also be stored in the stacked and covered steamer pans as long as a bottom pan (with no holes) is used.

### **Boiling Versus Steaming**

- In both boiling and steaming, moist heat is used to kill microorganisms.
- Steaming has several distinct advantages over boiling for the final processing of surgical gloves and other items such as plastic cannula and syringes.
- It is less destructive and more cost-effective for it uses much less fuel than boiling
- it is free from discoloration of instruments resulting from calcium or other heavy metals contained in some tap water for the steam contains only pure water molecules.
- Boiling Versus Steaming
- The major limitation of steaming is that if the steamers available locally are small, they can practically be used only for a small number of items
- For steaming to be effective, the bottom pan must contain enough water to continue boiling throughout the steaming process
- By contrast, large boiling pots are easier to use for metal instruments and do not need to be monitored the entire time to be sure that the process is being done correctly.

### **High-level disinfection using chemicals**

Although a number of disinfectants are commercially available in most countries, four disinfectants: OPA, Glutaraldehyde, Formaldehyde and Peroxide-are routinely used as high- level disinfectants.

These chemicals can achieve high-level disinfection if the items being disinfected are thoroughly cleaned before immersion. A high-level disinfectant should be selected for use based on the characteristics of the items to be disinfected, the physical area and the skills of personnel available to do the procedure.

Page 39 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

## Key steps in chemical high-level disinfection

- **STEP 1:** Thoroughly Clean instruments and other items that may have been contaminated with blood and body fluids and thoroughly clean and dry them before placing them in the disinfectant solution.
- **STEP 2:** Completely immerse all items in the high-level disinfectant.
- **STEP 3:** Soak them for 20 minutes.
- **STEP 4:** Remove items using high-level disinfected or sterile forceps or gloves.
- **STEP 5:** Rinse well with boiled and filtered (if necessary) water three times and air dry.
- **STEP 6:** Use promptly or store in a dry, high-level disinfected and covered container

## Factors That Affect Disinfection Process

- Quantity and location of the microorganisms
- Quantity and location of organic matter
- Concentration of the disinfectant
- Physical and chemical factors
- Duration of exposure
- Resistance of microorganism to the chemical agent

### 2.2.4. Sterilization

Sterilization is a process in which the destruction of all micro-organisms including bacterial endospores takes place. This can be achieved by either physical or chemical methods and is necessary especially for medical devices penetrating sterile body sites or having direct contact with the Sterilization in health facilities can be achieved by:

- I. High pressure steam (autoclaves),
- II. Dry heat (oven),
- III. Chemical sterilants (Glutaraldehyde or formaldehyde solutions)

## Essentials of Sterilization Process:

- I. The sterilants and sterilizing equipment must be validated and appropriate in design and operation to correctly integrate key yardsticks like: **time**, **temperature**, **contact**, **pressure** (for steam sterilization) and **right sterilants** (for chemical sterilization) to be as effective as they should be.

Page 40 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
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2. Instruments must be **thoroughly cleaned** to reduce dirt in order to guarantee effectiveness of the sterilization process. The higher the dirt the greater the challenge to the sterilization process. Therefore, it could be said that the effective sterilization is entwined with an effective removal of the dirt before making it ready for sterilization.
3. There must be **close and adequate contact** between the chemical sterilants and all surfaces and crevices of the device to be sterilized.

The effectiveness of any sterilization method is dependent upon four other factors

1. The type of micro-organism present.
2. The number of micro-organisms present.
3. The amount and type of organic material that protects the micro-organisms. Blood or tissue remaining on poorly cleaned instruments acts as a shield to microorganisms during the sterilization process.
4. The number of cracks and scratches on an instrument that might harbor micro-organisms.

Sterilization is a process, not a single event; therefore, all phases and steps in the process must be carried out correctly.

### I. High pressure steam sterilization method

Saturated steam is an extremely effective carrier of thermal energy that makes it many times more effective in conveying the necessary energy to the items to be sterilized than dry air. Steam is an effective sterilants in that it can soften any resistant and protective outer layer of the micro-organisms allowing coagulation of the inner sensitive portion of the micro-organisms.

#### Advantages

- Most commonly used effective method of sterilization.
- Sterilization cycle time is shorter in steam sterilization than in any other type of sterilization.

#### Limitation

- Requires a continuous source of heat (wood fuel, kerosene or electricity).
- Requires a trained biomedical technician to perform preventative maintenance.
- Requires strict adherence to time, temperature and pressure settings.

Page 41 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- Difficult to produce dry packs because breaks in procedure are common (e.g. not allowing items to dry before removing, especially in hot, humid climates).
- Repeated sterilization cycles can cause pitting and dulling of cutting edges of instruments i.e. scissors).
- Plastic items cannot withstand high temperatures.

There are three types of high-pressure steam sterilizers: Gravity displacement, Prevacuum and Flash or Immediate use sterilizers (IUS)

### Operation

A steam sterilizer will reliably sterilize items only when kept in good working condition and operated correctly. Sterilization by steam requires four conditions: Adequate contact, Sufficient temperature, Proper time and Sufficient moisture.

Even if these conditions are all necessary for sterilization to take place, sterilization failures in clinics and hospitals are most often caused by lack of steam contact or failure to attain adequate temperature. Effective sterilization depends on correctly following procedures of the process.

**These include:** Routine maintenance, Preparing items to be sterilized, Packaging and wrapping, Loading, Operating and Unloading the sterilizer.

### Routine Maintenance

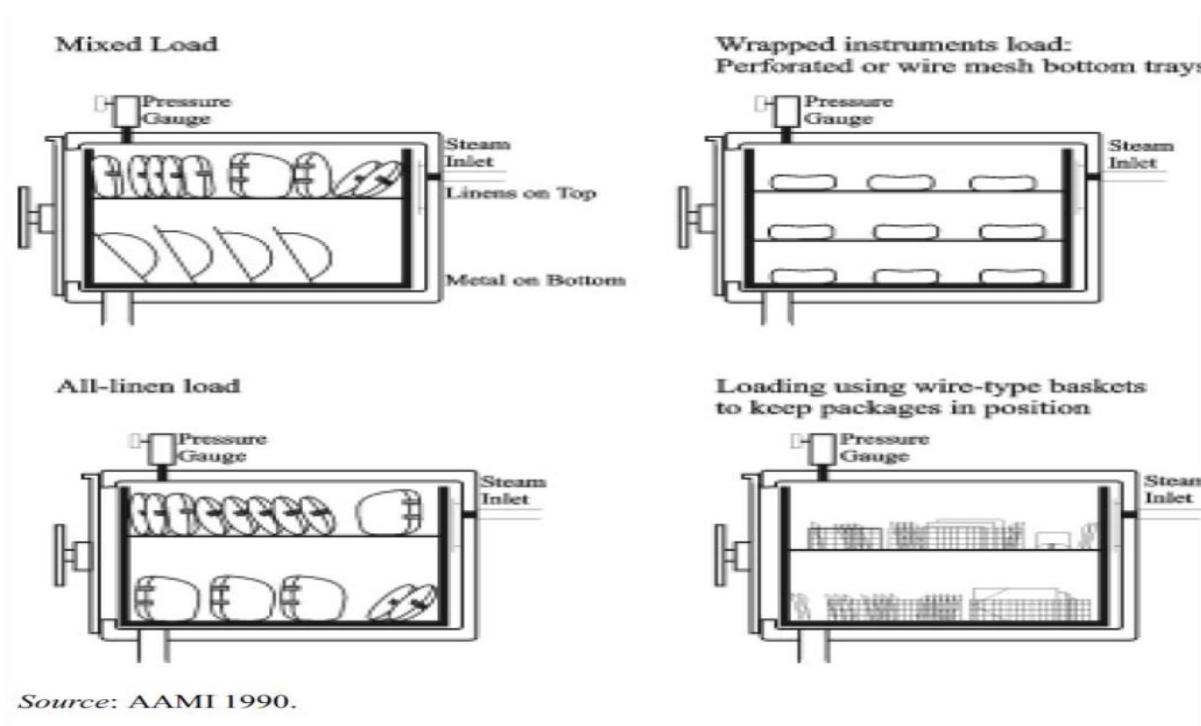
The chamber should be cleaned daily using a soft cloth, or for large sterilizers, a long- handled mop which is used only for this purpose. Do not use abrasives or steel wool because they may scratch the stainless steel surface and increase the occurrence of corrosion. All door gaskets should be cleaned daily with a lint-free cloth and checked for defects. Defective rubber gaskets should be replaced. The carriage (loading cart used to hold the packs placed in a sterilizer) should be cleaned daily using a mild soap and lint-free cloth. The exhaust line (or chamber drain) should be flushed weekly.

### Loading

To load items into the autoclave in such a way that it allows passage of the most steam through the load. The total weight of an individual pack should not exceed 11 kg (24 pounds). When loading, leave sufficient space for steam to circulate freely and avoid overloading. Always leave 3 inches between the top-most pack and the top of the chamber. Items should not touch the

Page 42 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

chamber wall. Never overload the sterilization chamber. Do not place packages on the floor of the chamber.



**Figure 2.4 Loading Steam Sterilizer**

### Unloading

To unload the steam autoclave so as to maintain the sterility of the items processed through a sterilizing cycle. Open the sterilizer door slightly 12-14 cm (5-6 inches) at the end of the cycle (when the chamber gauge reaches “0”) and allow items to remain inside to reduce the potential for condensation (formation of water drops on the packages). Allow instrument packs to dry completely before removal (usually takes 30 minutes). Cooling time could be as long as 2 hours, based on room temperature and humidity. Wet packs are never acceptable. Return any pack that is wet for reprocessing (remove items from the package and repackage before reprocessing). Do not handle the packs during the cooling time. Place sterile trays and packs on surfaces padded with paper or fabric (avoid placing warm packs on cold metal surfaces so as to prevent condensation). Store when packs reach room temperature (usually takes about an hour). Sterilized packs and articles should be handled gently and used as reasonably as possible. Return any pack that drops on the floor for reprocessing (remove items from the package and

repackage before reprocessing). If a pack is dropped, turns to be moist or comes into contact with moisture, it must be considered contaminated.

#### Instructions of operating a steam sterilizer

- **STEP 1:** Thoroughly clean and dry all instruments and other items to be sterilized.
- **STEP 2:** All jointed instruments should be in an open or unlock position, while instruments composed of more than one part or sliding parts should be disassembled.
- **STEP 3:** Instruments should not be held tightly together by rubber bands or any other means that will prevent steam contact with all surfaces.
- **STEP 4:** Arrange packs in the chamber to allow free circulation and penetration of steam to all surfaces.
- **STEP 5:** When using a steam sterilizer, it is best to wrap clean instruments or other clean items in a double thickness of muslin or newsprint. (Unwrapped instruments must be used immediately after removal from the sterilizer, unless they are kept in a covered, sterile container). Instructions of operating a steam sterilizer
- **STEP 6:** Sterilize at  $121^{\circ}\text{C}$  (250°F) for 30 minutes for wrapped items and 20 minutes for unwrapped items; set time of the clock.
- **STEP 7:** Wait 20 to 30 minutes (or until the pressure gauge reads zero) to permit the sterilizer to cool sufficiently. Then open the lid or door to allow steam to escape. Allow instrument packs to dry completely before removal which may take up to 30 minutes (Wet packs act like a wick drawing in bacteria, viruses and fungi from the environment). Wrapped instrument packs are considered unacceptable if there are water droplets or visible moisture on the package exterior when they are removed from the steam sterilizer chamber. If using rigid containers (e.g. drums), close the gaskets.
- **STEP 8:** To prevent condensation when removing the packs from the chamber, place sterile trays and packs on a surface padded with paper or fabric.
- **STEP 9:** After sterilizing, items wrapped in cloth or papers are considered sterile as long as the pack remains clean, dry (including no water stains) and intact. Unwrapped items must be used immediately or stored in covered sterile containers.

## Remember

- Maintain a steam sterilizer log including heat begun, correct temperature and pressure achieved, heat turned down, and heat turned off.
- Each load should be monitored with mechanical (time, temperature and pressure) and chemical (internal and external chemical test strips) indicators.
- Autoclave should be tested daily with an air-removal test to ensure proper removal of air.
- If steam escapes from the safety valve or under the lid, the autoclave is not working correctly. Rather, it is merely steaming items at low-pressure (which may be equivalent to HLD, not sterilization). Then, what is to be done?
  - ✓ If steam escapes from the safety valve instead of the pressure valve, the pressure valve must be cleaned and inspected.
  - ✓ If steam escapes from under the lid, the gasket (rubber ring) must be cleaned and dried or replaced.

## II. Dry heat sterilization method

Dry heat sterilization is caused by hot air that destroys micro-organisms through oxidation that causes slow destruction of the micro-organisms protein. It is accomplished by thermal (heat) conduction. Initially, heat is absorbed by the exterior surface of an item and then passed to the next layer. Eventually, the entire object reaches the temperature needed for sterilization. Dry heat sterilization methods have limited value because it is difficult to maintain the same temperature throughout the process. Moreover, dry heat sterilization takes longer than steam sterilization, because the moisture in the steam sterilization process significantly speeds up the penetration of heat and shortens the time needed to kill microorganism. Just as with steam sterilization, thorough cleaning of the object prior to dry heat sterilization is critical. If an instrument is not properly cleaned, effective sterilization cannot be ensured regardless of how long the instrument is heated.

## Advantages

- An effective method as dry heat reaches all surfaces of instruments by conduction , even for instruments that cannot be disassembled.

Page 45 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
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- Protective of sharps or instruments with a cutting edge (fewer problems with dulling of cutting edges).
- Leaves no chemical residue.
- Eliminates “wet pack” problems in humid climates.

### Limitation

- Plastic and rubber items cannot be dry-heat sterilized because temperatures used (160 to 170 °C) are too high for these materials.
- Dry heat penetrates materials slowly and unevenly.
- Requires oven and continuous source of electricity.

### Conditions for effective use of dry-heat sterilizers

- Adherence to specific instructions
- Airflow rate and distribution
- Load configuration and distribution
- Temperature
- Time

### Instructions for operating on dry heat oven

- **STEP 1:** Decontaminate, clean and dry all instruments and other items to be sterilized.
- **STEP 2:** If desired, wrap instruments in aluminum foil or place in a metal container with a tight- fitting closed lid. Wrapping helps prevent recontamination prior to use. Hypodermic or suture needles should be placed in glass tubes with cotton stoppers.
- **STEP 3:** Place loose (unwrapped) instruments in metal containers or on trays in the oven and heat them to the desired temperature.
- **STEP 4:** After the desired temperature is reached, begin timing. The following temperature/time ratios are recommended
- **STEP 5:** After cooling, remove packs and/or metal containers and store. Loose items should be removed with sterile forceps/pickups and used immediately or placed in a sterile container with a tight-fitting lid until the time of use.

## Recommended time cycle for dry heat sterilization

- 170<sup>0</sup> C (3400F) 60 minutes
- 160<sup>0</sup> C (3200F) 120 minutes
- 150<sup>0</sup> C (3000F) 150 minutes
- 140<sup>0</sup> C (2850F) 180 minutes
- 121<sup>0</sup> C (2500F) overnight

Depending on the temperature selected, the total cycle time (preheating, sterilization time and cool down) will range from about 2.5 hours at 170<sup>0</sup> C to more than 8 hours at 121<sup>0</sup> C.

- Heat treatment in 170<sup>0</sup> C (3400F) for an hour (total cycle time-placing instruments in the oven for an hour, and then cooling for 2 to 2.5 hours), or
- Heat treatment in 160<sup>0</sup> C (3200F) for 2 hours (total cycle time is from 3 to 3.5 hours).

## III. Chemical sterilization

Chemical sterilization is an alternative to high-pressure steam or dry-heat sterilization and often called “cold sterilization”. If objects need to be sterilized and when the availing methods like high-pressure steam or dry-heat sterilization would damage them or equipment are not available (or operational), they can be chemically sterilized. Many chemicals, both in liquid and gas form, are available for processing instruments. Chemicals that are approved as sterilants can also be used as high-level disinfectants but those approved only for HLD cannot be used as sterilants. Formaldehyde is no longer included as a sterilants or a high-level disinfectant due to its toxicity.

Instructions on the use of chemical sterilization

- **STEP 1:** Thoroughly clean and dry all instruments and other items to be sterilized.
- **STEP 2:** Check the expiry date on the container and prepare the chemical sterilant solution following manufactures instruction.
- **STEP 3:** Completely submerge items in a clean container filled with the chemical solution and place the lid on the container for the recommended period of time..

- **STEP 4:** Remove objects from the solution with sterile forceps; rinse all surfaces three times in sterile water; and air-dry them. Ideally, three separate (sequential) rinse containers should be used.
- **STEP 5:** Store objects in a sterile container with a tight-fitting lid if they will not be used immediately.

### 2.2.5. Storage of Sterilized and HLD Instrument

All sterile items should be stored appropriately to protect them from dust, dirt, moisture, animals and insects. The storage area should be located next to the place of sterilization or connected to it in a separately enclosed area with limited access that is used just to store sterile and clean patient care supplies.

#### Instructions for Storing Sterile Items

- Keep the storage area clean, dry, dust-free and lint-free.
- Control temperature and humidity (approximate temperature  $24^{\circ}\text{C}$  and relative humidity  $<70\%$ ) when possible.
- Packs and containers with sterile (or high-level disinfected) items should be stored 20 to 25cm off the floor, 45 to 50cm from the ceiling and 15 to 20cm from an outside wall.
- Do not use cardboard boxes for storage because cardboard boxes shed dust and debris and may harbor insects.
- Date and rotate the supplies (first in/first out). This process serves as a reminder, but does not guarantee sterility of the packs.
- Distribute sterile and high-level disinfected items from this area.

#### Shelf Life

The shelf life of an item (how long items can be considered sterile) after sterilization is event-related. An item remains sterile until something causes the package or container to become contaminated as time goes on since sterilization is not the determining factor. An event can be a

- Tear or worn-out area in the wrapping,
- The package becoming wet or
- Anything else that will enable microorganism to enter the package the package or container.

Page 48 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022



The shelf life of sterilization depends on the following factors

- Quality of the wrapper or container.
- Number of times a package is handled before use.
- Number of people who have handled the package.
- Whether the package is stored on open or closed shelves.
- Condition of storage area (e.g. humidity and cleanliness).
- Frequent or improper handling or storage.
- Use of plastic dust cover and method of sealing

## 2.5. Infectious waste management

### 2.5.1. Definition of Key Terms

- **Combustible wastes:** are those that can be burned or will easily catch on fire, and include paper, cardboard, and used dressings and gauze as well as some liquids and gases.
- **Cytotoxic waste:** contains by-products of drugs that kill dividing cells, used for treatment of certain cancers. This waste can include any items exposed to these drugs including sharps, personal protective equipment (PPE), and body fluids.
- **Disposal:** is the final step in health care waste management and entails intentional treatment of waste to render it harmless followed-by burial, deposit, discharge, dumping, placement, or release of waste material into the air or water or onto/into land.
- **Encapsulation:** is a process used when other options for safe disposal are not available. It involves surrounding hazardous waste with an immobilizing agent within sealed, solid waste containers to reduce the likelihood of future environmental, scavenger, or human contact with waste.
- **General waste:** does not pose any particular biological, chemical, radioactive, or physical hazard. health care waste, for example, sharps, pathological waste, pharmaceutical waste, and cytotoxic, chemical, and radioactive waste.
- **Health care wastewater:** is any water that has been adversely affected in quality during the provision of health care services.
- **Incineration:** is one method of waste disposal and involves controlled burning of solid, liquid, or gaseous combustible wastes that result in inorganic, non-combustible residue.

Page 49 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- **Infectious waste:** is waste that is potentially contaminated with blood, body fluids, or pathogenic organisms, including, but not limited to, laboratory cultures, microbiological stocks, excreta, and items soiled with blood or body fluids.
- **Municipal waste:** is general waste that is generated mainly by households, commercial activities, and street-sweeping. Ideally, it is collected by municipalities (e.g., local villages or cities) but in some locations this service is not available.
- **Residence time:** is the time that it takes between the entry of a waste substance into a furnace or incinerator and the exit of exhaust gases or burn-out residue from the furnace or incinerator.
- **Sanitary landfill** is an engineering method used for disposing of solid waste on land in a manner that protects the environment (e.g., by spreading the waste in thin layers, compacting it to the smallest practical volume, and then covering it with soil at the end of each working day).
- **Sewerage:** is the system for the collection and transport of human excrement and accompanying water used in toilet systems (sewage). The system includes conduits (channels) and pipes (sewers), and pumping stations.
- **Sharps waste:** includes used or unused sharps (e.g., hypodermic, intravenous, or other needles, auto-disable syringes, syringes with attached needles, infusion sets, scalpels, pipettes, knives, blades, and broken glass).
- **Standard Precautions:** are a set of infection control practices used for every patient encounter to reduce the risk of transmission of blood-borne and other pathogens from both recognized and unrecognized sources.
- **Waste management:** includes all activities, administrative and operational (including transportation activities), involved in the handling of waste: generation, collection, transport, storage, and disposal of waste.
- **Waste segregation:** is the systematic separation of health care waste into designated categories according to the type of composition and hazards, to enhance the safety and efficiency of waste handling and disposal.

## 2.5.2. Categories of Health Care Wastes

Categorizing the waste produced in health care facilities is a useful method of understanding the handling and disposal requirements for each type of waste. Approximately 75–90% of the general waste produced by health care facilities is non-contaminated and poses no risk of infection for those who handle it. Similar in nature to municipal waste, all or most general waste can be discarded in dumps or landfills or burned in incinerators (WHO 2014). Infectious waste from health care facilities must be handled and disposed of properly because they may carry microorganisms that have the potential to infect individuals who come in contact with them.

- **General waste:** Waste that does not pose any particular biological, chemical, radioactive, or physical hazard (e.g., paper boxes, newspapers and magazines, polyethylene bottles, polyester bags and wood).
- **Sharps waste:** Used or unused sharps (e.g., hypodermic, intravenous, or other needles, auto-disable syringes, syringes with attached needles, infusion sets, scalpels, pipettes, knives, blades, and broken glass).
- **Infectious waste:** Infectious waste is waste that is potentially contaminated with blood, body fluids, or pathogenic organisms, including, but not limited to, laboratory cultures, microbiological stocks, excreta, and items soiled with blood or body fluids.
- **Pathological waste:** Waste that contains human tissues or fluids, organs, body parts, fetuses, and unused blood products
- **Pharmaceutical waste:** Pharmaceuticals that are expired or no longer needed and items contaminated by or containing pharmaceuticals.
- **Cytotoxic waste:** Cytotoxic waste contains by-products of drugs that kill dividing cells, which are used for treatment of certain cancers. It also includes waste materials that can damage human genes (e.g., DNA) and may cause cancers or congenital deformities among babies.
- **Radioactive waste:** Waste containing radioactive substances (e.g., unused liquids from radiotherapy or laboratory research; contaminated glassware, packages, or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides; and sealed sources—

Page 51 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

### 2.5.3. Sources of Health Care Wastes

The types and amount of health care waste generated in a health care facility depend upon the size of the facility as well as the range of services provided. The larger the facility (e.g., university hospital, regional hospital) and the more services provided (e.g., tertiary health care facility with a trauma center, cancer treatment department), the more waste is produced and the greater variety of Waste generated.

- Medical ward
- Operating theater
- Laboratory
- Pharmacy store
- Chemotherapy
- Vaccination
- Campaigns
- Food services

### 2.5.4. Management of Health Care Waste

#### A. Reduction of Health Care Waste

The preferred strategies for reducing health care waste are to minimize waste generation by preventing waste production, reducing waste production, reusing and recycling waste, and recovering useful substances from waste. The least preferable strategy is treating and disposing of health care waste. Health care facilities can take several steps to minimize waste, including monitoring the consumption of hazardous substances and chemicals. Purchasing supplies with minimal packaging and using reusable medical devices, where feasible, are other ways to minimize health care waste. In addition, recycling waste when technologies are available will help minimize waste.

Chemical waste minimization options include:

- Using less toxic, environmentally friendly chemicals
- Using minimum concentrations when possible
- Ensuring good inventory control
- Designing proper storage areas
- Developing spill prevention and clean-up procedures (WHO 2014).

Page 52 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

## B. Segregation of Waste at Point of Generation

While general waste is the least expensive and easiest to dispose of, infectious and hazardous waste, which makes up 15% of waste, is more expensive and riskier to handle. When general waste is mixed with infectious or hazardous waste, the cross-contamination is introduced and all the resulting waste must be treated as infectious and hazardous. Use the following guidelines when disposing of infectious and general waste at the point of generation in all types of health care facilities:

- The HCW who generates the waste should segregate it where it is generated
- The waste should be separated into the local or WHO categories
- Separating wastes by hand after generation should not be allowed.
- Deposit infectious waste in color-coded, leak-proof, puncture-resistant container.
- Use leak-proof (plastic or galvanized metal) containers with tight-fitting covers for contaminated and hazardous wastes to protect patients and HCWs.
- Where available and feasible, use sturdy plastic bags/bin liners inside of the waste collection containers to assist with waste collection and transport. Do not re-use plastic bags or bin liners.
- Use puncture-resistant sharps containers for all disposable sharps (e.g., sharps that will not be reused).
- Utilize tools such as a kidney dish or bowl to separate waste and transport it safely from the point of waste generation to waste containers.

Table 2.3. WHO's Recommendation for Waste Segregation

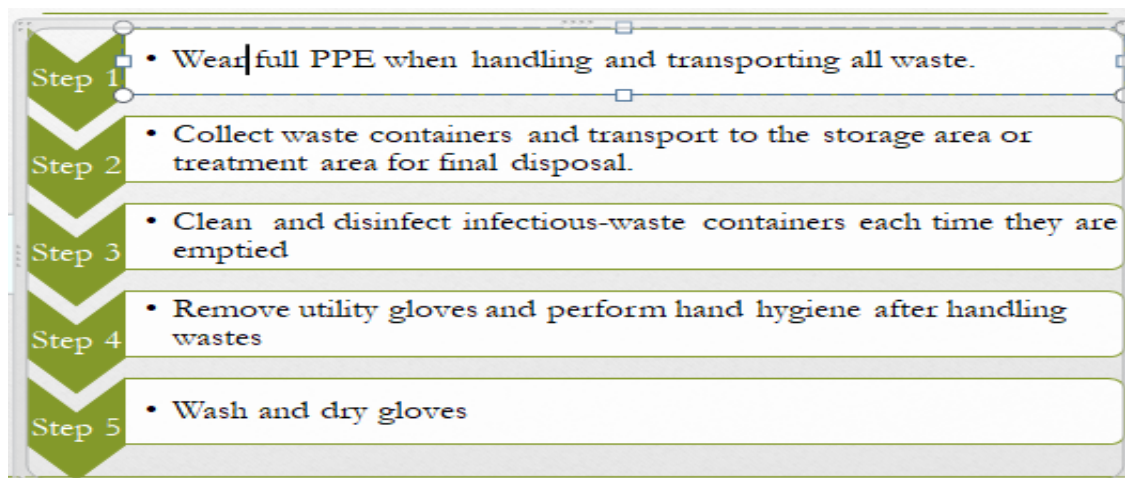
Type of Waste	Color of Container and Markings	Type of Container
Highly infectious waste	Yellow, marked —highly infectiousll with biohazard symbol	Strong, leak-proof plastic bag or container capable of being autoclaved
Other infectious waste, (includes all pathological waste)	Yellow with biohazard symbol	Leak-proof plastic bag or container
Sharps	Yellow, marked —SHARPSll with biohazard symbol	Puncture-proof container
Chemical and pharmaceutical waste	Brown, labeled with appropriate hazard symbol	Plastic bag or rigid container
Radioactive waste	Labeled with radiation symbol	Lead box
General health care waste	Black	Plastic bag or container

### C. Collection and Transportation of Waste in Health Care Facilities

Waste collection timetables for each route should be carefully planned according to the waste generation patterns of the various departments. Collect waste on a regular basis such as daily or sooner if needed according to the rate it is generated and the size of the waste containers. Do not mix infectious/hazardous and general waste during collection or transport. Collect and transport infectious waste to disposal sites in leak-proof, covered, contaminated-waste containers.

Do not use equipment (e.g., wheelbarrow, trolley/cart) that is used to hold and transport wastes for any other purpose in the health care facility. Use PPE when handling wastes.

### Steps for collection and transport of solid infectious wastes:



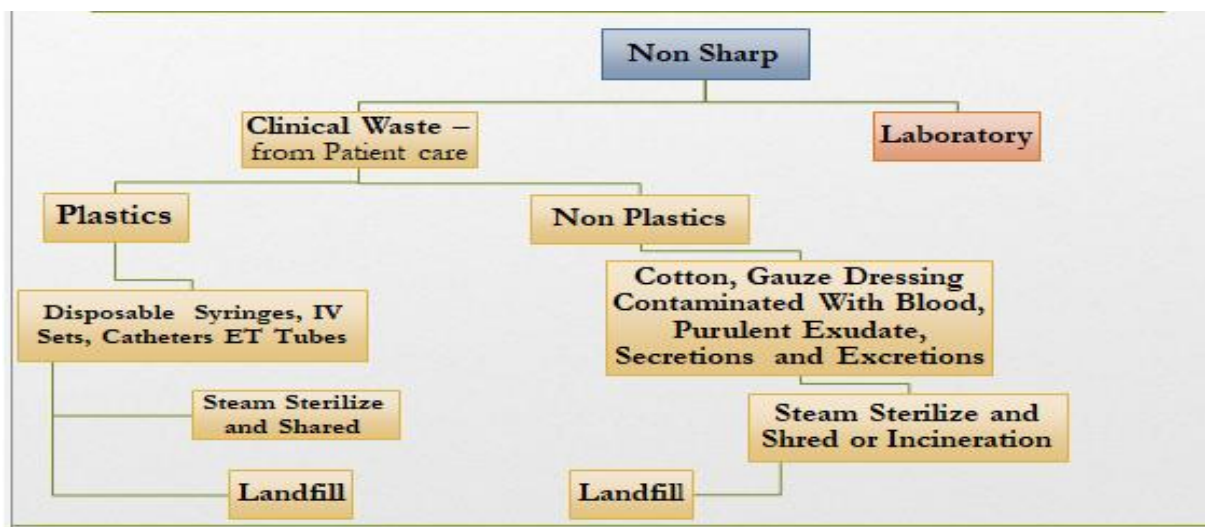
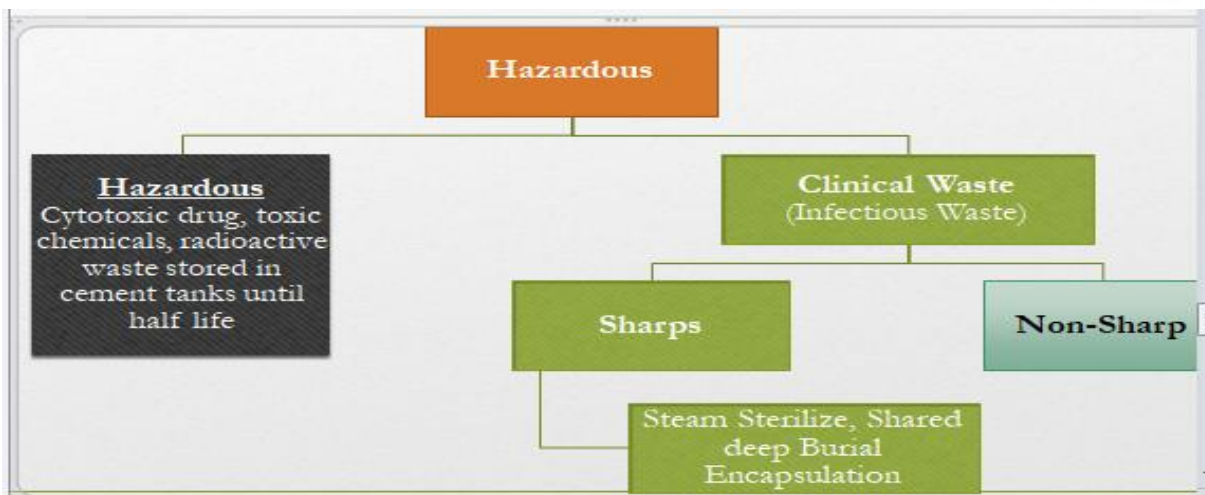
**Figure 2.5. Steps for collection and transport of solid infectious wastes:**

### Storage of Waste in Health Care Facilities

- The area of waste in health care facilities should be;
- An easy-to-clean, hard floor with good drainage
- Separate areas for infectious and general waste
- Separate cabinets to store pharmaceutical and other toxic wastes
- A good water supply with a sink for hand hygiene
- Regular cleaning
- Identification (signs) as a “waste storage area”
- Lockable door/gate.

### D. Disposal of Health Care Waste

Working towards safer waste disposal to protect the community and the environment is essential. Choosing the best currently available waste disposal method is essential. The frame work of waste disposal is clearly showed in the following picture.





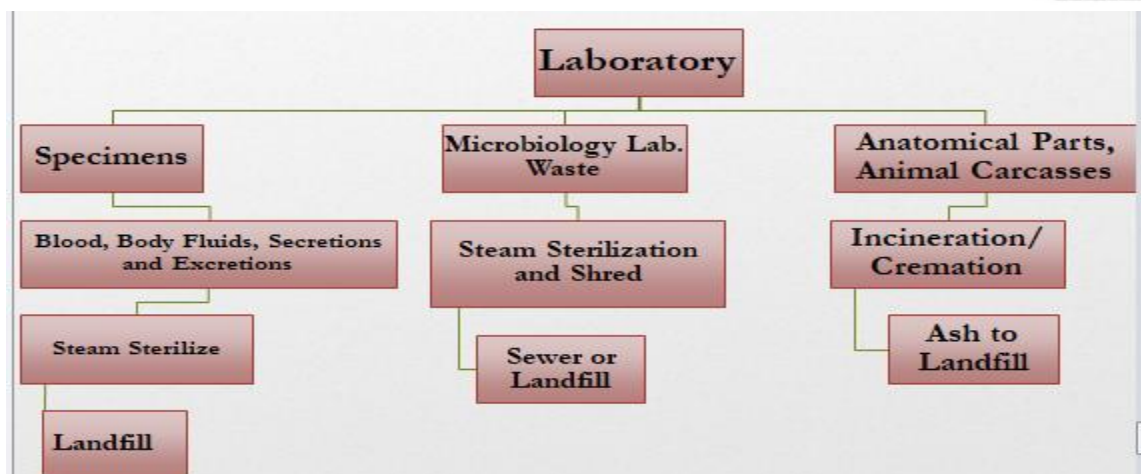


Figure 2.6. Frame work of waste disposal methods

## 2.6. Personal protective equipment (PPE)

### 2.6.1. Overview

Healthcare workers are confronted each day with the difficult question of how to work safely within the potentially hazardous environment of health care facilities.

The most common occupational risk the healthcare personnel face is due to contact with blood and body fluids during routine works like cleaning, instrument processing and patient care.

This exposure to pathogens increases risk of getting are Healthcare Associated Infections and possible death. Use of risk appropriate personal protective equipment (PPE) is one of the components of Standard Precautions, which refers to wearing of protective barriers or clothing. The basic principle behind wearing personal protective equipment is to get physical barrier/protection from pathogenic microorganisms. PPE includes: gloves, masks/respirators, eyewear (face shields, goggles or glasses), caps, gowns, aprons, boots and other items. The most effective barriers are made of treated fabrics or synthetic materials that do not allow water or other liquids (blood or body fluids) to penetrate them. However widely, these fluid-resistant materials are not, available because they are expensive. Unfortunately, lightweight cotton does not provide an effective barrier because moisture can pass through it easily, allowing contamination.

The state of the PPE is important for it to effectively provide protection. For example, surgical gowns and drapes have proved to be preventive for impending wound infection only when dry.

Page 57 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

When wet, however, clothes act as a wick or sponge to draw bacteria from the skin or equipment up through the fabric that can then contaminate a surgical wound. To be effective, PPE must be selected, worn and removed correctly.

As a rule, PPE selection should be based on risk assessment. If there is risk of exposure of patients or health workers then the PPE or combination of PPEs appropriate for the identified risk should be used. Effectiveness in protection is also dependent on the practice of correct procedures and adherence to rules for wearing (putting-on) and removing (putting-off) of PPE PPE should be;

Made available close to the point of use for easy accessibility

Stored neatly in a clean / dry area to prevent contamination until required for use. Preferably single use if reusable there must be a clear policy and standard operation procedure (SOP) for placement in bins after use and removal for laundering and recycling.

Have an SOP for stock ordering and rotation to ensure there is always an adequate supply based on usage and that older items are always used first.

Do not wait for stocks to run out before ordering more.

## 2.6.2. Definition of key Terms

- **Droplet nuclei:** are small particles involved in airborne transmission of pathogen-containing respiratory secretions expelled into the air by coughing.
- **Personal protective equipment (PPE):** items are the protective barriers and respirators used alone or in combination by a health care worker (HCW) to protect mucous membranes, airways, skin, and clothing from contact with harmful or infectious agents.
- **Droplet transmission:** occurs when infectious droplets larger than 5 µm in size are spread and land directly on or come in contact with a susceptible host.
- **Respirator fit testing:** is a test protocol conducted to verify that a respirator is both comfortable and correctly fits the user without leakage. Fit testing uses a test agent, either qualitatively detected by the wearer 's sense of taste, smell, or involuntary cough (irritant smoke) or quantitatively measured by an instrument, to verify the respirator 's fit.

### 2.6.3. Types and Use of PPE

As a rule, PPE selection should be based on risk assessment. If there is risk of exposure of patients or

health workers, then the PPE or combination of PPEs appropriate for the identified risk should be used. Effectiveness in protection is also dependent on the practice of correct procedures and adherence to rules for wearing and removing of PPE.

The different types of masks are listed below alongside their protection

- A. Cap=protects Hair and Scalp
- B. Goggles= protects the Eyes
- C. Face Masks= protects Nose, Mouth and Lower Jaw
- D. Face Shield= protects Face
- E. Gloves=protects Hand
- F. Gowns=protect Upper body, skin and cloth
- G. Apron=protect Front of the body
- H. Boots =protect Lower legs and feet
- I. Shoe cover

#### A. Caps

Head covers are most commonly used as part of surgical attire in surgical and procedure areas. When used, head covers or caps should be large enough to cover the entire scalp and hair . Facial hair is also required to be covered for surgical procedures in sterile areas using a facial hair covering. They can be disposable or made of reusable cloth that can be laundered. In the surgical and procedure areas, a new clean head covering should be worn each day and changed sooner when soiled with blood or body fluids. The same standard and regularity of cleaning expected for surgical scrubs should be applied when cleaning head/facial coverings (e.g., laundered at the hospital and changed at least daily).Caps are used to keep the hair and scalp covered so that flakes of the skin and hair are not shed up on the wound during surgery. Caps meant to be reliably protective should be large enough to cover all of the hair on the scalp.

#### Who wears caps?

- Health care workers wear caps to protect the patient from infection coming from hair and scalp
- Patients wear caps to keep the sterile field during invasive procedure

Page 59 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
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## B. Google

Eye protection should be comfortable, allow for sufficient peripheral vision and must be adjustable to ensure secure fit. Compared to older styles of goggles, newer styles may provide better indirect airflow properties to reduce fogging, provide better peripheral vision, and offer more size options for fitting goggles to different HCWs. Eye and face protection must be worn when there is risk of splashing body fluids onto mucous membranes e.g., eyes/nose. Eyes can be protected by wearing either goggles or a visor. If reusable eye/face protection is used, it should be decontaminated in accordance with the manufacturer's guidelines. Hands should always be decontaminated after removing the equipment. Personal eyeglasses and contact lenses are NOT considered adequate eye protection.

Suitable protective eye/face equipment should:

- As part of Standard Precautions
- As part of Droplet Precautions to protect from respiratory secretions
- During procedures and surgery when splashing is likely to happen
- Cover the entire face area (e.g. face shield) if protection of the mouth and nose area is also required
- Be changed if visibly soiled
- Be disposed of after use if single-use or placed into a receptacle for reprocessing

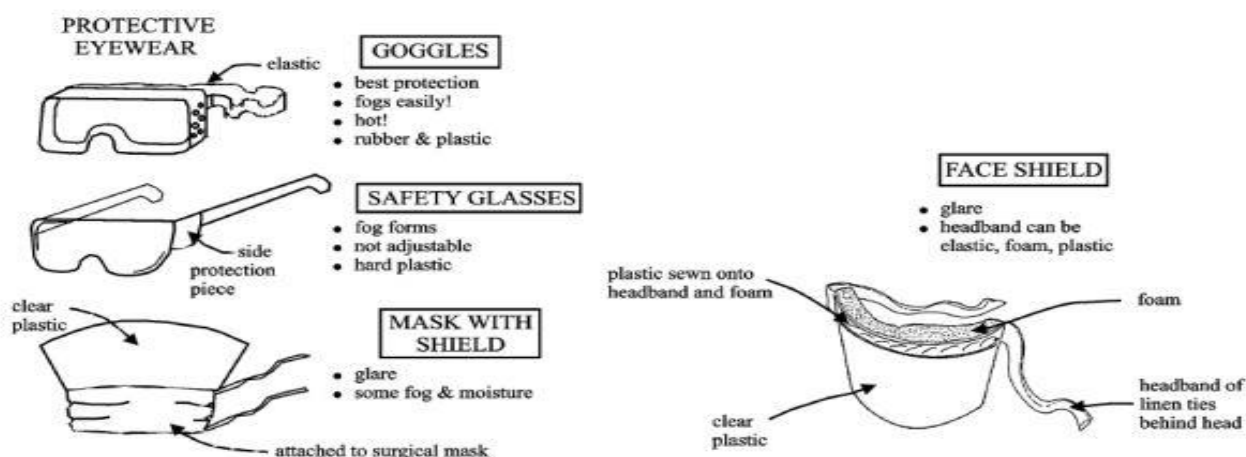


Figure 2.7. types of PPE

### How to don and doff a face shield

Put on eye protection after putting on the isolation gown and mask (if used) but before putting on Gloves. Removal of face shield, goggles, and mask can be performed safely after gloves have been removed. Use this video link for more clarification on face protection. The video clearly shows how to wear and take off google. [https://www.youtube.com/watch?v=4M4DCqN\\_ky8](https://www.youtube.com/watch?v=4M4DCqN_ky8)

### C. Face Mask

There are many different types of masks used to cover the mouth and nose. Masks made from cotton or paper are comfortable but are not fluid-resistant (do not protect from splashes) and are not an effective filter to prevent inhalation of microorganisms transmitted via droplet nuclei ( $\leq 5 \mu\text{m}$ ). The types of masks at clinical setup:

- I. **Surgical masks:** Regulated by WHO and other agency, require surgical masks to have fluid resistant-properties.
- II. **Procedure/isolation masks:** These are not regulated, and they do not have any specifications for their manufacture.

#### I. Surgical Masks

Masks should be large enough to cover the nose, the lower part of the face, the jaw and all of the facial hair. They are worn in an attempt to retain/confine moist droplets expelled as health workers or surgical staff speaks, cough or sneeze. Equally important, is its protective function against accidental splashes of blood or other contaminated body fluids on the health workers 'nose or mouth. This preventive function, however, would not be effective unless the masks are made of fluid-resistant materials. When removing, one should handle the masks by the strings do it with great care as the center of the mask is the most contaminated site of all other parts.

#### II. Procedure/isolation masks

Designed to create a physical barrier between the mouth and nose, isolation masks help protect against larger respiratory droplets, splashes, or germ particles (containing viruses and bacteria). However, the face mask does not filter or block small particles in the air that may be transmitted by coughs and sneezes. Avoid touching the outer layer of the disposable mask when removing it, as it could be contaminated.

Page 61 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

### III. Respirators

This are special types of masks called particulate respirators worn by healthcare personnel for protection against inhalation exposure to airborne infectious agents that are  $< 5\mu\text{m}$ . These include infectious droplet nuclei from patients with *Mycobacterium tuberculosis*, smallpox and dust particles containing infectious particles such as spores of environmental fungi. Respirators should be worn when filtering inhaled air is deemed important. The N95 disposable particulate and air purifying respirator is the type used most commonly by healthcare personnel. Other respirators used include N-99 and N-100 particulate respirators; powered air-purifying respirators with high efficiency filters; and non-powered full-face piece electrometric negative pressure respirators.



Surgical Mask



Respirator (N95)

Figure 2.8. Surgical mask and respirator from left to right

### D. Gowns

Gowns should fully cover the torso of the HCW, fit comfortably over the body, and have long sleeves that fit snugly at the wrists. There are three types of protective gowns used in health care facilities:

- I. Isolation gowns
- II. Surgical gowns
- III. Coverall suits

#### I. Isolation gowns

Page 62 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

Isolation gowns should be long-sleeved, fluid-resistant, single- use, and preferably disposable. Isolation gowns are designed to prevent contamination of HCWs arms, exposed areas of the body, and clothing from blood and body fluids and other potentially infectious material.

## II. Surgical gowns

Surgical gowns are sterile and preferably fluid-resistant, with sleeves that either taper gently toward the wrists or end with elastic or ties around the wrists. Large, droopy sleeves are not recommended because they can cause accidental contamination.

## III. Coveralls

Are full-body suits made from materials that are lightweight, breathable, and impermeable to liquids. These are to be worn by all HCWs who work in isolation areas for treating highly infectious diseases.

## When to wear gowns

The type of gown to use is based on the type of patient interaction, including the anticipated degree of contact with infectious material and the potential for blood and body fluid penetration of the barrier and the type of task to be carried out by the HCW:

- During standard precautions if blood or body fluid contact, splashes onto clothing is anticipated.
- During Contact and Droplet Precautions, an isolation gown (with gloves) is used to prevent transmission of an infectious agent that cannot be prevented by Standard Precautions alone.
- During surgical procedures, deliveries, or other aseptic procedures

## How to wear and remove gowns

Full coverage of the arms and body front, from the neck to the mid-thigh or below, will ensure that clothing and exposed areas of the upper body are protected. Isolation gowns are always worn in combination with gloves and other personal protective equipment

this video show how to wear and remove gown <https://www.youtube.com/watch?v=6OVMetPKo90>.  
another video <https://www.youtube.com/watch?v=e79YJ4ckwj0>.

## E. Plastic Apron

It is used to protect clothing or surfaces from contamination. Reusable aprons which are made of

Page 63 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022



rubber or plastic provide a waterproof barrier along the front of the personnel's body. Thus, it should also be worn during cleaning and procedures with likelihood of splashes or spillage of blood, body fluids, secretions or excretions (e.g., when conducting deliveries). Disposable water-proof aprons are also available for clinical use. Aprons keep contaminated fluids off the healthcare worker's clothing and skin.

## F. Gloves

Healthcare Workers Wear Gloves for the Following Three Reasons:

- To reduce the risk of acquiring infections to the staff from patients
- To reduce the risk of transmitting microorganisms from provider to clients/patients
- To reduce contamination of the hands of the staff by microorganisms which (cross-contamination).

## Types of Gloves

- **Surgical Glove:** should be used when performing invasive medical or surgical procedures. A sterile glove goes a step further than clean, in that it is additionally free from bacteria or microorganisms. When a glove is sterile, there is no micro-life form that has the potential to reproduce and spread dangerous germs or bacteria. Sterile gloves are used in procedure where the patient is at a high risk of infection. Sterile gloves are packaged in individual pairs in to keep new gloves completely free from any germs.
- **Clean or Examination Gloves:** provide protection to healthcare workers when performing many of their routine duties. These gloves can be used whenever contact with mucous membrane and non-intact skin is anticipated. A clean glove is one that doesn't have marks, stains, or dirt and debris present. Clean gloves can be used in certain medical scenarios where patients are not at a high risk of infection. Clean gloves typically come packaged in bulk, as in a large box where you pull out gloves as you need them.
- **Utility or Heavy-Duty Household Gloves:** should be worn when processing instruments, equipment and other items, for handling and disposing contaminated waste, and when cleaning contaminated surfaces. Double gloving of either new examination gloves or reprocessed surgical gloves provide some protection in case utility gloves are not available.



## When to Wear Gloves

Depending on the situation, surgical gloves, clean examination or utility gloves should be worn by all staff where:

- There is a chance of hands coming in contact with blood or other body fluids
- When performing invasive medical procedures (e.g., Inserting vascular devices such as peripheral venous lines).
- When handling contaminated waste items or touch contaminated surfaces.
- When cleaning the environment and home

## When to use double gloves

Even the best quality, new latex rubber surgical gloves may leak up to 4% of the time. Moreover, it was found that latex gloves gradually become weaker and lose their intactness especially when exposed to fat on surfaces of wounds.

- **Note:** The acceptable “leak rate for new surgical and examination gloves designated by regulatory agencies is up to 4%. Although double gloving is of little benefit in preventing exposure to blood in case of needle sticks or other similar injuries, it may decrease the risk of blood-hand contact.

## Double glove when

- The procedure involves coming in contact with large amounts of blood or other body fluids (e.g. vaginal deliveries and cesarean sections).
- Performing orthopedic procedures in which sharp bone fragments, wire sutures and other sharp edged materials are likely to be encountered.
- Performing surgical procedures lasting more than 30 minutes. (Most surgeons, these days use double glove routinely).

## How to make elbow length gloves

Page 65 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022



Figure 2.9. how to make elbow length glove

### Procedure for wearing Sterile Gloves

Sterile or surgical glove have its Owen techniques of wearing but for health information professional it is not mandatory to discussed the whole steps. If you want further use this video like to see all the necessary steps to wear surgical glove. <https://www.youtube.com/watch?v=cl7u3kjHYHY>.

### Some Dos and Don'ts about Gloves

- ✓ Do wear the correct size gloves
- ✓ Do change surgical gloves periodically every 45 minutes during long cases.
- ✓ Do keep fingernails trimmed moderately short to reduce the risk of tears.
- ✓ Do pull gloves up over cuffs of gown (if worn) to protect the wrists.
- ✓ Do use water-soluble hand lotions and moisturizers often to prevent hands from drying
- ✓ Don't use oil-based hand lotions because they will damage latex surgical and examination gloves.
- ✓ Don't use latex gloves if you or the patients have an allergy to latex.
- ✓ Don't store gloves in areas where there are extremes of temperature
- ✓ Don't reprocess gloves that are cracked or have detectable holes/tears.
- ✓ Don't reprocess examination gloves for reuse.

Page 66 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- ✓ Re-process utility gloves by immersing them in a 0.5% Chlorine solution briefly, remove gloves by inverting them and then soak them in the 0.5% Chlorine solution for 10 minutes before washing and drying them for reuse.

### Allergic reactions to gloves

Allergic reactions to latex rubber gloves are being increasingly reported among healthcare workers of all types including housekeepers, laboratory workers and dentists. If possible, non-latex (Nitrile) or low-allergen latex gloves should be used if allergy is suspected.

Furthermore, wearing powder-free gloves is recommended (Powdered gloves may result in more reactions). If at all this is not possible, wearing clothes or vinyl gloves beneath latex gloves may help to prevent skin sensitization. People with sensitivity do have symptoms like skin rashes, runny nose and itchy eyes that may persist or get progressively worse. An allergic reaction following the use of latex can develop within a month. Reactions generally take long time (3 to 5 years) to develop even in susceptible people and may not develop for as long as 15 years (Baumann, 1992).

**Note:** When using latex rubber gloves, avoid use of hand cream or lotions that contain mineral oil, petroleum jelly (Vaseline) or lanolin to protect your hands, because they may cause the gloves to break down within minutes.

### G. Footwear

It's worn to protect the feet from injury by sharp or heavy items or fluids that may accidentally spill over, drip, or even pour out upon them. All footwear should have closed toes, low heels, and nonskid soles. Clean, sturdy shoes are recommended for all clinical areas. Rubber boots or leather shoes provide the best protection. They must be kept clean. For this reason, sandals and other open-toe shoes or shoes made of soft materials are not acceptable. Rubber boots or leather shoes are acceptable, but they must be kept clean and free of contamination from blood or other body fluid spills. Shoe covers are unnecessary if clean and sturdy shoes are available for dedicated use only in the surgical area. However, Shoe covers may be needed to minimize contamination from and of shoes.

Note: There may be instances where PPE to protect the HCW from infectious disease may be required in addition to surgical attire, such as a respirator for surgery on a patient with known or suspected TB or additional skin coverage for surgery on a patient with known or suspected viral hemorrhagic fever.

Page 67 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

#### 2.6.4. Types of Personal Protective Equipment during Disease Outbreaks

List of Personal Protective Equipment (PPE) recommended by the World Health Organization (WHO) for HCWs who provide care and treatment to Viral hemorrhagic fever (e.g. Ebola) patients includes:

- Fluid-resistant coverall or gown:
- Without an attached hood
- With thumb holes or loops
- Waterproof apron
- Waterproof boots
- Fluid-resistant isolation mask with a design that does not collapse against the mouth
- Face shield
- Respirator—required when performing aerosol-generating procedures is anticipated
- Head cover that covers head and neck (separate from the gown or coverall)
- Double gloves with cuffs to mid-forearm (nitrile preferred over latex)

#### 2.6.5. Putting on and removing PPE

Putting on and removing PPE in the proper order and manner is just as important as wearing PPE. Failure to properly put on or remove PPE could lead to exposure to or lack of protection against infectious agents. The order of putting on PPE and removing PPE depends upon the purpose for which the PPE is being used.

##### Sequence for Putting on PPE for Standard and Transmission-based Precautions

- Put on protective boots or shoe covers (if needed).
- Perform hand hygiene.
- Put on a gown.
- Put on a procedure mask/N95 respirator.
- Put on goggles or a face shield.
- Lastly, put on gloves.

##### Sequence for removing PPE for Standard and Transmission-based Precautions

- Remove gloves.
- Remove goggles/ face shield by the “clean” head band or ear pieces.

Page 68 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
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- Remove the gown.
- Remove the mask or respirator.
- Dispose of single-use and reusable PPE in designated containers.
- Remove shoe covers or boots (if used) before leaving the area.
- Perform hand hygiene.

### **Sequence for Putting on PPE for Sterile Surgical Procedures in the Operating Theater**

- Change from street clothes to a clean scrub suit (one that has been processed in the health care facility laundry). Remove all jewelry.
- Put on non-skid, low-heel shoes with closed toes and back, rubber boots, or shoe covers when there is a risk of gross contamination with blood or body fluids.
- Perform hand hygiene.
- Put on a plastic apron if the sterile surgical gown is not fluid-resistant.
- Put on a surgical head cover (and facial hair cover, if needed) to ensure that hair on the head (and beard) are fully covered.
- Put on a surgical mask, one that fits well and fully covers the mouth and the nose.
- Put on appropriate sized, well-fitting goggles or a chin-length face shield.
- Perform a surgical hand scrub using soap and water and ABHR Put on a sterile surgical gown without contamination.
- Lastly, put on sterile surgical gloves without contamination.

### **Sequence for Removing PPE following Sterile Surgical Procedures in the Operating Theater**

- Remove the gloves following the recommended steps and dispose of in a waste container; do not reprocess or reuse the gloves.
- Remove the gown, avoid touching the outer side of the gown, and dispose of in a waste container (if a single-use gown) or place the used gown in a container for processing later.
- Remove the plastic apron, if one was used, and dispose of in a waste container (if a single-use apron) or place the used apron in a container for processing later.
- Remove eye protection.

Page 69 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- Remove the surgical mask.
- Perform hand hygiene.
- These steps will be performed at the end of day unless any item becomes soiled.
- Remove the head cover (and facial cover).
- Remove shoe covers (if worn).
- Remove shoes.
- Remove scrub suit.
- Lastly, perform hand hygiene.

## 2.7. Hand washing

Hand hygiene is the single most important infection prevention and control (IPC) precaution and one of the most effective means to prevent the transmission of pathogens within health care services. Hand hygiene is a general term that includes hand washing, antiseptic hand rub, and surgical hand antisepsis.

Hand washing: the action of performing hand hygiene for the purpose of physically or mechanically removing dirt, organic material, and/or microorganisms.

Alcohol hand rub: applying an antiseptic hand rub to reduce or inhibit the growth of microorganisms without the need for a water source and requiring no rinsing or drying with towels or other devices.

Surgical hand antisepsis: antiseptic hand wash or antiseptic hand rub performed preoperatively by the surgical team to eliminate transient flora and reduce resident skin flora. Such antiseptics often have persistent antimicrobial activity.

### 2.7.1. Kinds of Hand Hygiene Practices

- I. Hand washing with soap and water (antimicrobial hand washing)
- II. Antiseptic Hand-rub
- III. Surgical Hand scrub

The decision to choose which type of hand hygiene practice to use depends on:

- Intensity of contact with patient and /or blood and body fluids,
- The likelihood of microbial transmission,
- Patient's susceptibility to infection, and
- Procedure being performed

Page 70 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

## I. Hand washing with soap and water (antimicrobial hand washing)

### Purpose:

- To mechanically remove soil and debris from skin and reduce the number of transient microorganisms.
- It is THE SINGLE most important measure in reducing the spread of infection!



Figure 2.10. Hand washing with soap and water (antimicrobial hand washing)

## 5 Moments of Hand Hygiene

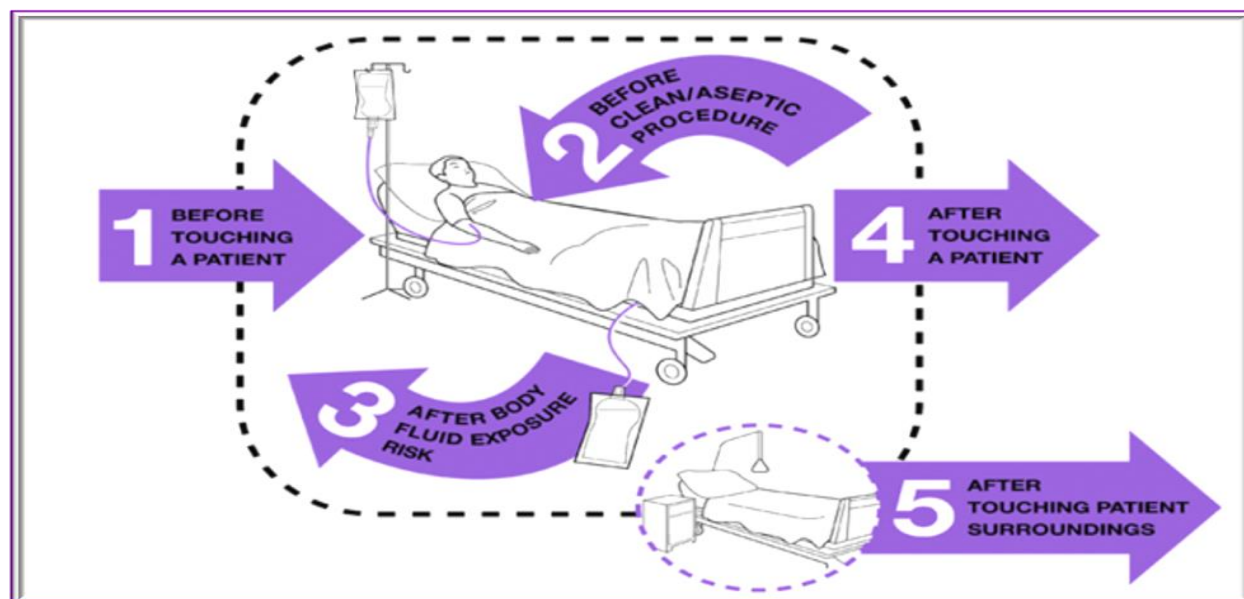




Figure 2.11. 5 moments of hand washing

### Other opportunities for hand hygiene

- Immediately on arrival and before departure from work (the health facility).
- Immediately after touching contaminated instruments or articles
- Before putting on gloves and after removing them
- Whenever the hands become visibly soiled after nasal blowing or following a covered sneeze
- Before touching the face (eyes, nose or mouth)
- Before and after cleaning the environment
- Before and after preparing food
- Before eating and drinking or serving food
- After visiting the toilet



Figure 2.12 most frequently, frequently and less frequently missed areas during hand washing

### Hand Washing Technique

Page 72 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022



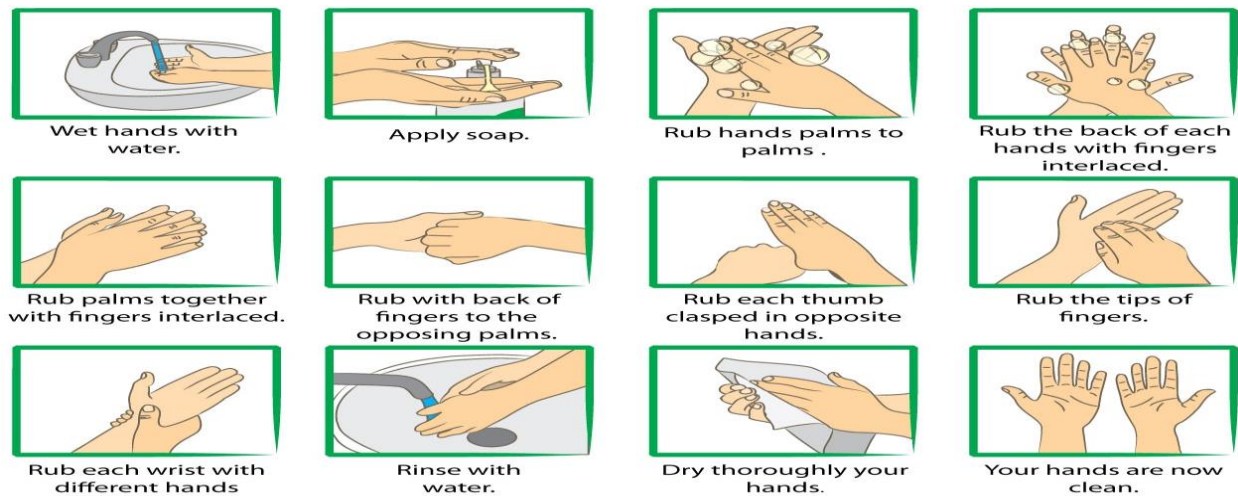


Figure 2.13 hand washing technique

## II. Antiseptic Hand rub

### • Purpose:

- ✓ To inhibit or kill transient and resident flora.
- Considered to be more effective than antimicrobial hand washing agents or plain soap and water,
- It is quicker and easier to perform, but it should not be used when the hands are visibly soiled.
- Do not rinse hands after applying hand rub

### Advantages of Alcohol-based hand rub

- Require less time
- Act faster
- More accessible than sinks
- More effective for standard hand washing than soap
- Can even provide improved skin condition.

### Antiseptic Hand rub Technique

- Apply enough alcohol-based hand rub to cover the entire surface of hands and fingers
- Continue rubbing the solution over hands until they are dry (15-30 seconds)
- Rub the solution vigorously into hands, especially between fingers and under the nails, until dry

Page 73 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
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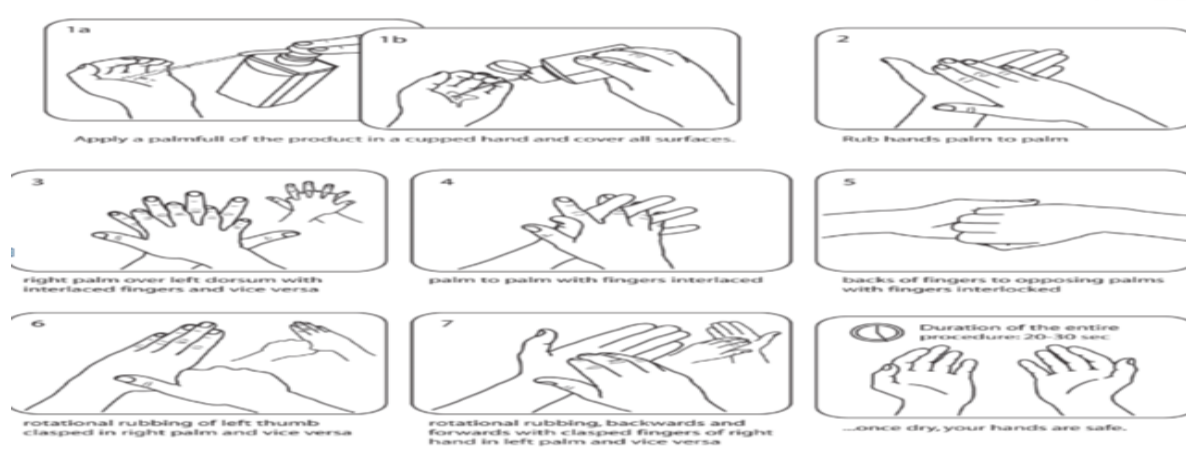


Figure 2.14 hand rub technique

## WHO-recommended Hand Rub Formulations

### Formulation 1:

- To produce final concentrations of ethanol 80% v/v, glycerol 1.45% v/v, hydrogen peroxide ( $H_2O_2$ ) 0.125% v/v:
  - ✓ Pour into a 1,000-mL graduated flask:
  - ✓ Ethanol 96% v/v, 833.0 mL
  - ✓  $H_2O_2$  3%, 41.7 mL
  - ✓ Glycerol 98%, 14.5 mL
- Top up the flask to 1,000 mL with distilled water or water that has been boiled and cooled; shake the flask gently to mix the contents.

### Formulation 2:

- To produce final concentrations of isopropyl alcohol 75% v/v, glycerol 1.45 v/v, hydrogen peroxide 0.125% v/v:
  - ✓ Pour into a 1,000-mL graduated flask:
  - ✓ Isopropyl alcohol (with a purity of 99.8%), 751.5 mL
  - ✓  $H_2O_2$  3%, 41.7 mL
  - ✓ Glycerol 98%, 14.5 mL

- Top up the flask to 1,000 mL with distilled water or water that has been boiled and cooled; shake the flask gently to mix the contents.
- v/v=volume percent, meaning 80 parts absolute alcohol in volume and 20 parts water measured as volume, not as weight
- Do not add ABHR to a partially empty dispenser, to avoid contamination
- The use of refill packets avoids this problem but if they are not available, the dispensers should first be thoroughly cleaned and dried before refilling. (WHO 2009a)

### Use of Antiseptic soap vs. alcohol based hand rub (ABHR)

- Hand washing with antiseptic soap is more irritating to the skin and more expensive than using ABHR.
- Therefore, if available, ABHR should be used under normal circumstances (WHO 2009a)

### III. Surgical Hand scrub

#### Purpose:

- To mechanically remove soil, debris and transient organisms and to reduce resident flora for the duration of the surgery
- Steps in Surgical Hand-scrub
  - ✓ Remove rings, watches, and bracelets.
  - ✓ Thoroughly wash hands and forearms to the elbow with soap and water.
  - ✓ Clean nails with a nail cleaner.
  - ✓ Rinse hands and forearms with water.
  - ✓ Apply an antiseptic agent (soap)
  - ✓ Vigorously wash all surfaces of hands, fingers, and forearms for at least 2 minutes.
  - ✓ Rinse hands and arms thoroughly with clean water, holding hands higher than elbows
  - ✓ Keep hands up and away from the body, do not touch any surface or article. and dry hands with a clean, dry towel
  - ✓ Put on sterile or HLD gloves.

#### Why Healthcare Workers Don't Wash Their Hands?

- Hand washing between every patient encounter is unnecessary,

Page 75 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
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- Hand washing doesn't affect clinical outcome,
- Hand washing is unnecessary when gloves are worn,
- Frequent hand washing damages skin and causes cracking, dryness, irritation and dermatitis,
- Hand washing damages nails and nail polish
- Hand washing facilities are not conveniently placed or well designed,
- Hand washing takes too much time....etc.,

### **Issues and considerations related to hand hygiene**

#### **Gloves:**

- Wearing gloves do not replace the need for hand hygiene.

#### **Hand lotions and hand Creams:**

- hand lotions, creams and moisturizing skin care products that are water based and without fragrance can be used
- Do not use oil based barrier products

#### **Lesions and skin Breaks**

- Cuticles, hands, and forearms should be free from lesions
- Cover any cuts or abrasions with waterproof dressings

#### **Finger nails and artificial nails**

- Keep nails short, Long nails may serve as a reservoir for microorganisms and tend to puncture gloves more easily..

#### **Nail polish**

- Dark colored nail polish may prevent dirt and debris under fingernails from being seen and removed.
- Issues and considerations related to hand hygiene cont'd...

#### **Jewelry**

- Current evidence demonstrates that wearing rings increases hand contamination
- Do not wear wrist watches and jewelry including wearing rings with ridges or stones

Page 76 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

### **Sleeves**

- Keep sleeves short or rolled up

### **Water safety**

- Used clean water, treat unsafe water

### **Hand Care**

Hand care is important to protect the skin from drying and cracking. Cracked skin may encourage microbial colonization and broken areas can present a site of entry for pathogens. Hand creams can be applied to care for the skin on hands. Communal tubs of hand cream must be avoided as these may contain bacteria over time, and lead to contamination of hands.

## Self-check-2

**Directions:** Answer all the questions listed below.

Part I: write “True” if the statement is correct or “False” if the statement is incorrect

1. Antiseptic Hand rub used to inhibit or kill transient and resident flora.
2. Heavy or utility glove provide protection to healthcare workers when performing many of their routine duties.

Part II: choose the correct answer among the alternatives for the following multiple choice questions

1. Refers to any environment, in which infective agents can live, parasitizes and breed.
  - A. Infectious agent
  - B. Susceptible host
  - C. Portal of entry
  - D. Reservoir
2. Which one is component of standard precaution?
  - A. Hand hygiene
  - B. Airborne precaution
  - C. Contact p precaution
  - D. Droplet precaution
3. One of the following is considered to be methods of disinfection
  - A. Use Autoclave
  - B. Use Dry Heat
  - C. Use hydrogen peroxide 6 hrs. At 20°C (68°F)
  - D. Use hydrogen peroxide hrs. At 25°C (77°F)

**Part III write correct and short answer for the following essay item questions**

1. Differentiate between standard precaution and transmission-based precaution
2. List the 5 moments of hand washing

## Operation sheet-1

**Operation Title:** Instrumental processing

**Instruction:** Read each step carefully and assess, manage and provide health education to the mother and child related to nutritional problem. the scale of the performance is described below;

- 2= step performed completely
- 1= step performed partially
- 0= step does not performed

**Purpose:** To process reusable medical equipment

**Required tools and equipment:**

- Clean water
- 3 basins
- Soap and water
- Utility glove
- Detergent
- Brush
- Sterilizer (autoclave or dry heat)
- Chemical solution

**Procedures:** look in the following table

Step	Activity	Performance		
		2	1	0
Instrumental processing				
1.	Wash your hand appropriately			
2.	Wear PPE			
3.	Prepare detergent and clean water			
4.	Clean the instruments			
5.	Dry the instruments			
6.	Pack the instrument			
7.	Label the packed instrument (date and time)			

8.	Sterilize the instrument based on the protocol			
9.	Store in dry and clean place			

### Quality criteria:

- There are 35 steps in this operation sheet
- Each step has a value of 3 points.  $9 \times 3 =$  a total of 27 points
  - ✓ A score of 85% and more is competent
  - ✓ A score of 70% up to 85 is satisfactory
  - ✓ A score of below 70% is unsatisfactory



## Unit Three: Limit Contamination

This learning unit is developed to provide the trainees the necessary information regarding the following content coverage and topics:

- Demarcate clean and contaminated zone
- Keep records, materials and medicaments in a clean zone
- Keep contaminated instruments and equipment in Contaminated zone

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify clean and contaminated zone
- Keep records, materials and medicaments in a clean zone
- Confine contaminated instruments and equipment in Contaminated zone

### Learning Instruction

- Read the specific objectives of this Learning Guide.
- Read the information written in the information
- Accomplish the “Self-check 3”

### 3.1. Demarcating and maintaining clean and contaminated zones

When something has been exposed to infectious agents it is considered to have been contaminated. Ways to limit contamination in the healthcare setting may include:

- Cleaning surfaces
- Protecting all materials, equipment and instruments from contaminants
- Maintaining sterile objects
- Being aware of the guidelines for single-use objects.

An important strategy to limit contamination in healthcare settings is to set and maintain:

- Clean zones
- Treatment zones
- Contaminated zones.

Maintaining these three zones helps reduce the risk of contamination. it is the responsibility of every person working in the healthcare environment to:

- understand where the clean, treatment and contaminated zones are
- do what is required to maintain them.

#### 3.1.1. Zones

Maintaining clean, treatment and contaminated zones helps reduce the risk of contamination and makes it easier to remember that anything entering a clean zone must first be decontaminated.

##### A. The clean Zone

Clean areas include those surfaces and drawers where clean, disinfected or sterilized instruments are stored and never come in contact with contaminated instruments or equipment. The clean zones are areas where non-contaminated items are kept. Example of these items and zones include:

- Sterile instruments
- Clean linen
- Medical records
- Kitchen preparation areas
- Supply stores.

Before entering a clean zone, it is important to remove contaminated gloves and other PPE and perform hand hygiene (decontamination).

## **B. The treatment Zone**

The treatment zone is where items are currently being used by the client or healthcare worker. For example, the client's bedside is a treatment zone as it has been exposed to microorganisms.

## **C. Contaminated zone**

Contaminated zones are for objects and waste that is waiting for decontamination sterilization or disposal. The contaminated zone boundaries should be clearly defined, because this has implications for surface management and for the placement of equipment. Instruments placed into the contaminated zone for a treatment session but not used during the session must be regarded as contaminated. For this reason, all bulk supplies such as opened boxes of gloves, cotton rolls or gauze must be stored outside the contaminated zone and protected from contamination from splashes and aerosols. An example of this zone is a linen skip, in which used linen is stored while awaiting decontamination in the laundry. If there is any possibility that any item may have been contaminated, it should be treated as if it has been contaminated.

### **3.1.2. Workflow**

To maintain the separation of clean and contaminated zones, workflow should be from the cleanest to the most contaminated areas – this ensures that there is never any movement of contaminated items into clean zones. The cleanest to most contaminated approach also applies to cleaning surfaces, when you should start at the cleanest area and work out toward the most contaminated area. Make sure that cleaning equipment is correctly decontaminated and stored after use, to prevent it becoming another source of contamination.

Objects that have moved from the clean to the contaminated zone may only return when they have been cleaned, decontaminated, or sterilized as required. Take them from the contaminated zone, decontaminate them, and then place them in the clean zone. Be careful not to place a newly decontaminated item back in a contaminated zone, such as on a contaminated bench.

If there is a possibility that something may possibly have been contaminated, it should be treated as if it has definitely been contaminated. Many healthcare facilities use dedicated trolleys

Page 83 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

and containers for holding and moving contaminated items and clean or sterile items, and you must ensure that the correct trolleys and containers are used. If a single trolley is used for both, it must be thoroughly cleaned before use for clean items. Clean and contaminated items can never be placed on the trolley together.

There are two basic rules to follow to limit contamination.

- Maintain clean zones and contaminated zones within the workplace.
- All movement of instruments and equipment must be from clean to contaminated.

The aim of barrier nursing is to protect the HCW but also the community from transmission of Infectious disease. Proper barrier management is the cornerstone in containing the spread of Infectious disease in healthcare settings.

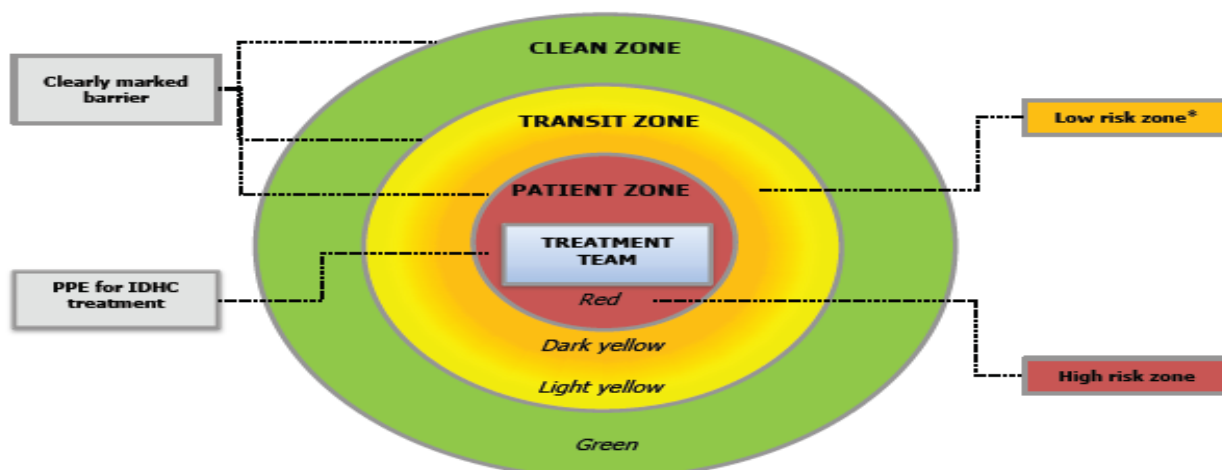
### 3.1.3. Zone and Color Code

As shown on figure 3.1 each zone has its own standard color code.

- **Red zone:** this is Patient treatment area, point of care and diagnostics takes place. After visible contamination, cleaning and disinfection of HCW also takes place here.
- **Dark yellow zone:** First re-entry step for staff exiting the red zone. Assisted disinfection and doffing for exit HCW Potentially contaminating processes, such as cleaning and disinfection of boots and waste bags. Preparing waste for further processing, such as packaging waste bags in containers with non-removable clip-on lids. This area is Storage of waste and Hand disinfection for HCW before stepping into the green zone.
- **Red Yellow Zone:** Second step re-entry of staff from light yellow zone
  - ✓ Complete assisted donning for entry HCW
  - ✓ Briefing and de-briefing of staff
  - ✓ Inbound and outbound communications
  - ✓ Staff coordination and supervision of activities

Figure 3.1. Zone and color code of health facility

Page 84 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022



Yellow zone needs to be conceived as with a gradient dark yellow to light yellow according to the decrease in risk of contamination.

Functionally, the yellow zone needs to be understood as the decisive area, in which secondary contamination is prevented and controlled: Here a contaminated HCW exiting from the red zone is brought in to clean conditions, which enable him or her to safely re-enter the green zone. In addition, any material coming from the red zone, such as waste bags, re-usable PPE items, patient samples needed to be processed outside of the isolation unit are first cleaned and disinfected in the yellow zone. A particular function lies in the temporary storage of considerable amounts of waste produced every day in the nursing of a patient with an Infectious disease.

### Practical hints

- Different zones need to be clearly marked.
- Prevention and control of secondary contamination happens in the yellow zone.
- The yellow zone has a virtual gradient from 'high potential for contamination' (dark yellow) to 'low potential of contamination' (light yellow).
- Instructions for staff should be displayed at the entry of the isolation area.
- If there is a cross-contamination incident outside the red zone (e.g. patient leaving the red zone), the contaminated area has also to be considered as a red zone. New yellow and green zones need to be established around the new red zone. The zones can be put back into normal function by room disinfection, once the patient has been dismissed.

Page 85 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- Donning and doffing areas must be separated and visually marked. The donning area is in the green zone.
- The doffing area must be in the dark yellow zone, but has to be clearly separated from the light-yellow zone

### 3.2. Keep records, materials and medicaments in a clean zone

A clean zone is an area that is relatively free from contaminants. It is crucial that materials, equipment, medications and records are all kept in clean areas so there is no risk of people getting infections from these items? Consider the requirements outlined here.

#### Storage Area

A range of equipment, such as personal care, fitness, recreation and cleaning equipment, is used in aged care facilities along with materials such as cleaning products. These items need to be kept somewhere that is safe, clean, does not interfere with other duties and can be readily accessed when required. Linen also needs to be stored so that towels and bedding can be replaced as part of

a regular cleaning schedule or when needed.

#### Medication storage

Medication needs to be stored so that it is safe from misuse and readily accessible. It is important the medication is kept in airtight containers to prevent contamination. Containers must be kept upright to prevent leaks and must be clearly labelled. Ensuring items do not touch is equally important.

#### Sterile storage

Some items are sterilized after use. Sterile stock must be kept in an environment free from germs (an aseptic environment). All sterile stock should be kept in sterile packs that have external process indicators. These indicators change color if the equipment is no longer sterile. Sterile items should not be placed on the floor, nor should they come into direct contact with the roof. Sterile items should never be kept in cardboard boxes, as cardboard is porous and the items could become contaminated.

#### Administration areas

Administration areas are sections of a facility dedicated to processing and storing paperwork. Most aged care facilities have a reception area that is open to the public and other offices that

Page 86 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

are accessible only to authorized personnel. Administration areas can be zones within rooms that have other purposes. For example, if an aged care worker updates case notes in a client's room, the area where the worker stands or sits becomes the administrative area. Contaminated items must never be kept in administration areas.

All records that are kept and archived should be kept in a clean zone. All packaging materials and medicaments should be kept in a clean zone. These items should not be stored in a contaminated zone or a risk of cross contamination will occur.

### 3.3. Keep contaminated instruments and equipment in Contaminated zone

In home environments, storage will depend on the people living there and their visitors. People who live with or who have small children visiting must keep medication out of children's reach or in cupboards with childproof locks.

When items are received into the sterilizing facility, all reusable items that have been used or unused during patient treatment need to be cleaned in a physically separate area to prevent possible contamination of processed items

### Self-check-3

**Directions:** Answer all the questions listed below.

Part I: write "True" if the statement is correct or "False" if the statement is incorrect

1. Before entering a clean zone, it is important to remove contaminated gloves and other PPE and perform hand hygiene.
2. All records that are kept and archived should be kept in a clean zone.

Part II: choose the correct answer among the alternatives for the following multiple choice questions

1. \_\_\_\_\_ is where items are currently being used by the client or healthcare worker
  - A. Clean zone
  - B. Treatment zone
  - C. Contaminated zone
2. A range of equipment, such as personal care, fitness, recreation and cleaning equipment, is used in aged care facilities should be placed
  - A. Storage area

Page 87 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- B. Medication storage
- C. Sterile storage
- D. Administrative areas

Part III: write correct and short answer for the following essay item questions

1. Identify and explain zone and color codes of work flow in health facility
2. List examples of items placed in clean zones include



## Unit Four: Clean environmental surfaces

This learning unit is developed to provide the trainees the necessary information regarding the following content coverage and topics:

- General principles of environmental cleansing
- Wearing personal protective equipment
- Remove dust, dirt and physical debris from work surfaces
- Clean work surfaces
- Dry work surfaces
- Replace work surfaces
- Maintaining and storing equipment

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Define key terms.
- Identify the necessary PPE for environmental cleansing and housekeeping.
- Remove dust, dirt and physical debris from work surfaces and clean work surface
- Dry work surfaces appropriately
- Explain how to replace work surfaces
- Maintain and store equipment

### Learning Instruction

- Read the specific objectives of this Learning Guide.
- Read the information written in the information
- Accomplish the “Self-check 3”

#### 4.1. Definitions of Key Terms

- **Biofilm:** is an accumulated, thin layer of bacteria and extracellular material that tightly adheres to surfaces (e.g., skin drains, urinary catheters) and cannot be easily removed.
- **Cleaning:** is the removal of visible dirt from objects and surfaces, normally accomplished manually or mechanically, using water with detergents or enzymatic cleaners.
- **Cleaning Solution:** is any combination of soap or detergent and water, with or without a chemical disinfectant used to wash or wipe down surfaces such as floors, chairs, bench tops and walls.
- **Contact time:** is the length of time a cleaning product must remain wet on the surface being cleaned for the disinfectant to kill the targeted microorganisms.
- **Detergent (soap):** is a cleaning product that lowers surface tension of water, thereby helping to remove dirt and debris.
- **Disinfectant Cleaning Solution:** is a product that is a combination of detergent (soap) and a chemical disinfectant. It is true, that not all detergents and disinfectants are compatible.
- **Disinfectants:** are chemicals that destroy or inactivate microorganisms.
- **Environmental cleaning:** it is the general cleaning of surfaces and equipment to reduce the number of microorganisms present and providing a clean and pleasant atmosphere.
- **Environmental Controls:** activities of keeping standards specifying procedures to be followed for the routine care, cleaning and disinfection of surfaces, beds, bedrails and bedside equipment
- **Frequently touched surfaces:** are surfaces in patient care areas in the health care facility with frequent hand contact.
- **Non-critical items:** for the purposes of cleaning and disinfection, are items that come into contact with intact skin but not mucous membranes (e.g., blood pressure cuffs, stethoscopes, and crutches).

Page 90 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- **Sanitizer:** a chemical that reduces the number of bacterial contaminants on inanimate objects to safe levels based on public health requirements
- **Sterilants:** these are Chemicals used to destroy all forms of microorganisms including endospores.

## 4.2. General Principles for Cleaning

- Scrubbing (frictional cleaning) is the best way to physically remove dirt, debris and microorganisms.
- Cleaning is required prior to any disinfection process because dirt, debris and other materials can decrease the effectiveness of many chemical disinfectants.
- Cleaning products should be selected on the basis of their use, efficacy, safety and cost.
- Cleaning should always progress from the least soiled areas to the most soiled areas and from high to low areas so that the dirtiest areas and debris falling on the floor will be cleaned up last.
- Dry sweeping, mopping and dusting should be avoided to prevent dust, debris and microorganisms from getting into the air and landing on clean surfaces.
- Instructions for mixing (dilution) should strictly be followed when using disinfectants.

## 4.3. Wearing Personal protective equipment (PPE)

### 4.3.1. PPE for environmental cleansing

When cleaning environmental surface it is highly recommended to wear personal protective equipment. Under the current Covid-19 risk, the essential cleaning PPE will be gloves and aprons, ideally simple disposable ones, or with a careful routine of cleaning if not. Other personal protective equipment like mask, shoes, eye ware also required.

#### A. Aprons

They can range from basic ones below waist, to more commercial ones covering the whole person and 'hanging' around the neck. They can also be a variety of colors and designs, with any relevant logos and contact details for the cleaning firm using them



P	Author/Copyright		Version -1 April, 2022
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Figure 4.1. Wearing apron for environmental cleansing

## B. Glove

These not only help protect hands from substances and harm, but can likewise help prevent germs and bacteria from people's hands being directly transferred onto items being cleaned and used. Therefore, cleaning without gloves should be very infrequent



Figure 4.2. Heavy utility glove

### 4.3.2. PPE for Housekeeping

The housekeeping staff in health facilities deals with dirt, soils and other materials that expose them to risks of infections and other health hazards. To avoid this hazardous exposure, they have to be equipped with the relevant personal protective equipment. Some of personal protective equipment for housekeeping purposes is:

- Gloves preferably the utility or Heavy-duty gloves
- Protective shoes
- Plastic or rubber apron
- Masks
- Protective eye wears

The housekeeping staffs should use the above-mentioned PPEs for: -Handling disinfectant cleaning solutions, cleaning patient care areas, cleaning heavily contaminated areas, handling soiled linens, handling soiled items and instruments, handling or disposing of wastes and When spills or splashes are expected

Page 92 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

#### 4.4. Remove dust, dirt and physical debris from work surfaces

Dust, soil and microbial contaminants on environmental surfaces are potential source of HAIs. Maintaining a clean workplace increases productivity and safety. It also decreases the likelihood of adverse, work-related health issues. Necessary levels of cleanliness vary by industry. The needs of a food processing facility, for example, are typically going to be more extensive than those of a machine shop. Determining the optimal level of cleanliness to meet health, safety and production needs allows facilities to create cleaning, sanitizing and disinfecting regimens that are realistic and not overly burdensome. Unlike many situations where going “above and beyond” is a good thing, over-cleaning may be wasting time and resources.

Cleaning a surface removes visible dirt, dust and debris. Sweeping floors, washing windows and wiping spills from countertops are examples of cleaning. When facilities establish routine cleaning schedules and adhere to them, they reduce the likelihood of dirt, spills and clutter creating unsafe working conditions.

#### 4.5. Cleaning work surfaces

##### 4.5.1. Prepare a Disinfectant Cleaning Solution

The disinfectant cleaning solutions contain both disinfectants for decontamination and detergents (soap) for cleaning.

##### Ways of preparing disinfectant cleaning solutions.

- **STEP 1:** Prepare a 0.5% Chlorine solution from liquid concentrates or from Chlorine powder compounds. Alternative disinfectants that can be used include 1 to 2% Phenols or 5% Carbolic acid.
- **STEP 2:** Add enough detergent to the 0.5% Chlorine solution or another disinfectant to make a mild and soapy cleaning solution.

When we use Chlorine solution, we should be very cautious. Although chlorine-containing solutions (sodium hypochlorite) are excellent and inexpensive disinfectants, they should not be mixed with cleaning solutions containing an acid (e.g. phosphoric acid) like Ammonia or Ammonium chloride

Page 93 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
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(NH Cl). So doing will release chlorine gas and other by- products that can result in temporary illness (nausea, tearing, headache or shortness of breath) of the staff inhaling fumes in a poorly ventilated area.

### For liquid bleach

$$\text{Total parts (TP) (H}_2\text{O)} = \left[ \frac{\% \text{ Concentrate}}{\% \text{ Dilute}} \right] - 1$$

$$\text{Total parts (TP) (H}_2\text{O)} = \left[ \frac{5\% \text{ Concentrate}}{.5\% \text{ Dilute}} \right] - 1 = 9 \text{ Total parts (TP) (H}_2\text{O)}$$

Figure 4.3 preparation of liquid bleach

- To make a 0.5% chlorine solution from 5% bleach, mix 1 part bleach to 9 parts water.

### For powder form

$$\text{Gram/Liter} = \left[ \frac{\% \text{ Dilute}}{\% \text{ Concentrate}} \right] \times 1000$$

$$\text{Gram/Liter} = \left[ \frac{.5\% \text{ Dilute}}{35\% \text{ Concentrate}} \right] \times 1000 = 14.2 \text{ Gram/Liter}$$

Figure 4.4 Preparation powder form

- To make a 0.5% chlorine solution form a 35% chlorine powder, mix 14.2 grams of powder chlorine to 1 liter of water

### 4.5.2. Cleaning Methods

Cleaning should start with the least soiled area and extend to the most soiled area and from high to low surfaces. Before started cleaning it is necessary to prepare cleaning solution and the full steps will be discussed on the operation sheet of this learning outcome.

Common methods of cleaning are briefly described below:

#### Wet Mopping Method (Preferable for Floor Cleaning)

- **Single-Bucket (Basin) Technique:** one bucket of cleaning solution is used here. The solution, however, needs to be changed when dirty. (The killing power of the cleaning product decreases with the increased load of soil and organic material present).
- **Double-Bucket Technique:** two different buckets are used here-one containing a cleaning solution and the other containing water for rinsing. The mop is always rinsed

and wrung out before it is dipped into the cleaning solution. The double-bucket technique extends the life of the cleaning solution (fewer changes are required) saving both labor and material costs.

- **Triple-Bucket Technique:** the third bucket is used for wringing out the mop before rinsing which extends the life of the rinse water.

### **Flooding Followed by Wet Vacuuming Method**

- It is preferable for surgical suits.
- It eliminates mopping and minimizes the spread of micro-organisms.
- It increases the contact time of the disinfectant and the area to be cleaned.
- Preferably, it should be done at night when the traffic flow of the facility is low.

### **Dusting:**

- Should be used for cleaning walls, ceilings, doors, windows, furniture and other environmental surfaces. Clean clothes or mops are made wet with cleaning solution contained in a basin or bucket. The double-bucket system minimizes the contamination of the cleaning solution.
- Dry dusting should be avoided, and dust cloths should not be shaken either for fear of spreading of micro-organisms.

**Dry Vacuuming:** This is recommended only for cleaning carpets.

### **4.6. Drying work surfaces**

After cleaning is done, the final stage of cleaning is to dry the surface, and it's recommended that you air dry where possible. You can use drying cloths if needed, but they should be single use if so, especially in a commercial setting. You must not air dry any drying cloths that are damp from use and reuse them, as bacteria could grow on the cloths and pose a contamination risk. By this point, the surface will be fully cleaned and most, if not all, microorganisms will have been destroyed, depending on the substances you used.

#### 4.6.1. Drying Textile

All textiles (e.g., bed sheets, surgical drapes, and gowns) used in the direct care of a patient must be thoroughly washed and dried before reuse. Laundering removes pathogens from textiles, making them hygienically clean and ready for use. Laundered textiles are not sterile and are not required to be, including for neonatal intensive care units. Laundering standards in hospitals should address key, specific standards, for example, water quality and temperature, amount of agitation needed, and chemical properties needed to properly clean surgical attire. Effective laundering is dependent on the following factors, which, when used together, have a greater effect than when used separately:

- Duration of cleaning
- Mechanical action (i.e., agitation)
- Chemicals used in the process
- Temperature of water and air in the machine dryer

If one of these factors is decreased (e.g., temperature), then other factors (e.g., chemicals, mechanical action, or time) must be increased to result in the same level of cleanliness.

#### 4.6.2. Drying, Inspecting, and Folding Textiles

Steps to dry, inspect, and fold hand- and machine-washed textiles:

- I. Completely air or machine-dry cleaned textile before further processing. A cycle in the dryer has been associated with elimination of pathogenic bacteria. For air-drying, direct sunlight is preferred. Keep the fabric off the ground, away from dust and moisture.
- II. After textiles are totally dry, check for holes and threadbare (worn) areas. If these are present, the item must be discarded or repaired before reuse or storage:
- III. Air-dried textiles should be ironed. Ironing has been associated with the elimination of pathogenic bacteria and is essential to prevent parasites in some regions.
- IV. Clean, dry textiles should be folded. If sterile textiles are required

#### 4.7. Replace surface covers

Commercial surface covers are available in a variety of shapes and sizes and are often cut to fit the instrument or equipment they protect - air/water syringe handle covers, hose covers, pen sheaths, etc. They generally are made of clear plastic supplied as wraps, bags, or tubes, or as plastic-backed paper. Some barriers contain a mild adhesive on one side to keep them in place

Page 96 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022



on the surface; others might use a drawstring closure to secure the cover; and some plastics "cling" when placed in contact with a smooth surface. In selecting environmental surface barriers, the primary feature is impermeability, and any material manufactured and advertised as a surface barrier should be supplied with evidence of the impermeable nature of the product.

## 4.8. Maintaining and storing equipment

### 4.8.1. Storing Equipment

All sterile items should be stored appropriately to protect them from dust, dirt, moisture, animals

and insects. The storage area should be located next to the place of sterilization or connected to it

in a separately enclosed area with limited access that is used just to store sterile and clean patient

care supplies. In smaller clinics, this area may be just a room close to the Central Supplies Department or in the Operating Room.

### 4.8.2. Instructions for Storing Sterile Items

- Keep the storage area clean, dry, dust-free and lint-free.
- Control temperature and humidity (approximate temperature 24°C)
- Packs and containers for items should be stored 20 to 25cm off the floor, 45 to 50cm from the ceiling and 15 to 20cm from an outside wall.
- Do not use cardboard boxes for storage because cardboard boxes shed dust and debris and may harbor insects.
- Date and rotate the supplies (first in/first out). This process serves as a reminder, but does not guarantee sterility of the packs.
- Distribute sterile and high-level disinfected items from this area.

### 4.8.3. Shelf Life

The shelf life of an item (how long items can be considered sterile) after sterilization is event-related. An item remains sterile until something causes the package or container to become contaminated as time goes on since sterilization is not the determining factor. To make sure items remain sterile until you need them, prevent events that can contaminate sterile packs and

Page 97 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

protect them by placing them in plastic covers (thick polyethylene bags). An event can be a tear or worn-out area in the wrapping, the package becoming wet or anything else that will enable microorganism to enter the package becoming wet or anything else that will enable microorganism to enter the package or container.

Before using any sterile item, look at the package to make sure that the wrapping is intact and the seal is unbroken, clean and dry (as well as having not water stains).

If the quality of wrapping clothes is poor and plastic bags are not available, limiting the shelf life is a reasonable option to resort to and secure the sterility of the instruments.

#### 4.8.4. Storing Hygienically Clean Textiles

Procedures for proper storing of hygienically clean textiles:

- Store clean textiles in clean, closed storage areas.
- Store clean textiles in an area free of pests, dust, and lint and at room temperatures of 20–25.6°C (68–78°F).
- Use physical barriers to separate folding and storage rooms from soiled areas.
- Ensure that storage shelves are: 2.5 to 5 cm (1 to 2 inches) from the wall
- Bottom shelf: 15 to 20 cm (6 to 8 inches) from the floor
- Top shelf: 30 to 45 cm (12 to 18 inches) below the ceiling
- Keep shelves clean and textiles covered, which can be achieved by: covering clean textiles on a clean cart
- Wrapping bundles of clean textiles in plastic or other suitable material and closing securely and Restrict access to the laundry storage room to authorized staff.

#### The Shelf Life of Sterilization Depends on the Following Factors:

- Quality of the wrapper or container.
- Number of times a package is handled before use.
- Number of people who have handled the package.
- Whether the package is stored on open or closed shelves.
- Condition of storage area (e.g. humidity and cleanliness).
- Frequent or improper handling or storage.
- Use of plastic dust cover and method of sealing (AORN, 1992).

Page 98 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

## Self-check-4

**Directions:** Answer all the questions listed below.

Part I: write “True” if the statement is correct or “False” if the statement is incorrect

1. Chlorine solution should be very cautious not be mixed with cleaning solutions containing an acid.
2. When cleaning environmental surface it is highly recommended to wear personal protective equipment.

Part II: choose the correct answer among the alternatives for the following multiple choice questions

- I. \_\_\_\_are chemicals that destroy or inactivate microorganisms.
  - A. Detergents
  - B. Disinfectants
  - C. Sanitizers
  - D. Sterilants
2. Which cleaning method is appropriate for floor cleansing
  - A. Wet mopping method
  - B. Flooding followed by wet vacuuming
  - C. Dry vacuuming
  - D. Dusting

Part III: write correct and short answer for the following essay item questions

1. Some of personal protective equipment for housekeeping purposes is:
2. List the instructions for Storing Sterile Items

## Unit Five: Assess and Control Risk and Hazard

This learning unit is developed to provide the trainees the necessary information regarding the following content coverage and topics:

- Organizational procedures for hazard identification, assessment and control of risks.
- Identification of all hazards at the planning, design and evaluation stages
- Developing and maintaining hazard risk control measures
- Identifying inadequacies in existing risk control measures
- Protocols for care following exposure to blood or other body fluids

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify Developing organizational procedures for hazard identification, assessment control of risks.
- Identify of all hazards at the planning, design and evaluation stages
- Develop and maintaining hazard risk control measures
- Identify inadequacies in existing risk control measures
- Explain protocols for care following exposure to blood or other body fluids

### Learning Instruction

- ✓ Read the specific objectives of this Learning Guide.
- ✓ Read the information written in the information
- ✓ Accomplish the “Self-check 3”

## 5.1. Develop organizational procedures for hazard identification and control of risks.

### 5.1.1. Identify Infection risks

A risk is the chance, high or low, that a hazard will cause harm, injury or ill health, or the likelihood, or possibility, which harm (injury, illness, death, damage etc.) may occur from exposure to a hazard. A hazard is a situation or item that could cause harm. Risks and hazards should be monitored so they are minimized, protecting the health and wellbeing of all workers and clients.

**Risk Assessment:** Is defined as the process of assessing the risks associated with each of the hazards identified so the nature of the risk can be understood. This includes the nature of the harm that may result from the hazard, the severity of that harm and the likelihood of this occurring.

**Risk Control:** Taking actions to eliminate health and safety risks so far as is reasonably practicable. Where risks cannot be eliminated, then implementation of control measures is required, to minimize risks as far as is reasonably practicable. A hierarchy of controls has been developed and is described below to assist in selection of the most appropriate risk control measure/s.

**Monitoring and Review:** This involves ongoing monitoring of the hazards identified, risks assessed and risk control processes and reviewing them to make sure they are working effectively. Health care facilities are ideal settings for the transmission of nosocomial infections in the following ways:

- Invasive procedures have the potential to introduce microorganisms.
- Service providers and support staff are constantly performing clinical procedures or other activities (susceptible host). Clients receiving services may be harboring microorganisms.

### Who Is at Risk of Infections?

Service providers and support staff: Health care personnel, including support staff (e.g., housekeeping, laundry staff, and maintenance), who work in health care settings are at risk of

Page 101 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

exposure to serious, potentially life-threatening infections such as HIV, hepatitis B virus (HBV), and hepatitis C virus (HCV).

All workplaces are legally obliged to have processes in place to identify infection risks, as well as policies and procedures to provide workers with guidance on how they should respond to such risks.

Every person in the workplace, from trainee personal care workers through to senior management, has work health and safety (WHS) obligations. These obligations include taking all reasonable steps to prevent the spread of infection. Knowledge of infection risks and appropriate responses is an essential part of meeting WHS requirements.

### 5.1.1. Activities and tasks that put clients and/or other workers at risk

healthcare workers (HCWs) are essential to the health of the world's population, they, themselves, are often put in physical jeopardy. Globally, HCWs are exposed each day to a variety of health and safety hazards, including:

- Biological
  - ✓ pathogens such as Human Immunodeficiency Virus, Hepatitis B Virus , Hepatitis C Virus, Ebola, Mycobacterium Tuberculosis , SARS virus and Neisseria Meningitis)
- Sharp's injuries
- Ergonomic, (e.g., heavy lifting)
- Psychosocial, (e.g., violence and stress)
- Chemical, (e.g., chlorine, glutaraldehyde, ethylene oxide)
- Radiological and nuclear

Safe work leads to worker well-being and retention, increased productivity and economic best outcomes. Risks and hazards are fluid and need monitoring and adjustments made to the appropriate safety plans and processes

#### The risk to staff arises from:

- from sharps and hollow needles
- splashing of conjunctivae and mucous membranes with contaminated blood
- heavy contamination of broken skin, e g. cuts, dermatitis etc.

Page 102 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- handling of large quantities of blood and body fluids without protective clothing.

### **The risk to patients arises from:**

- use of recycled hollow needles and syringes
- contaminated blood transfusion
- heavy soiling of the environment
- poor ward facilities and cleaning

### **5.1.2. Applying Response to infection risks**

To successfully identify and respond to infection risks we must understand and follow safe work practices that prevent the transmission of infections.

As a health worker it is also your responsibility to follow recommended procedures in your workplace and take adequate precautions to protect yourself from injury and infection.

Risk management is the process of making health care safer for the patient, staff and visitors by identifying hazards in the workplace and taking action to minimize their harm wherever possible. There are a number of steps in the risk management process:

- identifying the hazard
- assessing the risks
- Using control measures
- Identifying a hazard

A hazard is anything with the potential to cause harm to you, the patients, your co-workers or visitors to the work area. In the sterilization setting this includes chemicals, sharps such as needles, soiled instruments, power, water, steam, noise, and heat.

In developing procedures or buying new equipment, identify these risks early so that work practices can be developed that ensure the hazard is eliminated as much as possible. Regular safety inspections and audits can help identify and manage hazards. All employees, patients, volunteers, contractors and visitors that enter the work place have a responsibility to behave in a safe and responsible manner and report any hazards or near accidents.

**Assessing the risks:** It is important to assess the risks associated with each hazard to determine how it can be eliminated. Is there a high risk of injury or is the hazard a result of a combination of unusual circumstances that may never re-occur? Budgets are limited in health

Page 103 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

care settings, so it is important to look at all the options for dealing with a hazard. You should also document the process to seek additional support for action.

**Control measures:** The more serious the consequence, the more urgent it is for the risk to be dealt with and eliminated immediately. If the risk cannot be eliminated it may be possible to circumvent the risk of injury by changing practice. The last alternative is to use some form of personal protection when exposed to the hazard.

When deciding on control measures this should be a team effort so that management and staff work together. The control measures should not impose another risk.

**Monitoring control measures:** Once control measures have been implemented it is important to monitor and re-evaluate practice to ensure compliance with new practice.

### 5.1.3. Preparing Procedures for risk control

#### Strategies to identify risks

Strategies for identifying risks vary. Risk identification can be proactive or reactive. The following contains information about proactive and reactive strategies that can help management and workers identify hazards that present risks to health and safety.

#### Proactive strategies

- A proactive strategy is one carried out to prevent an accident or incident; for example, implementing processes to identify hazards and risks. Two examples are a job safety analysis (JSA) and an audit.
  - ✓ A JSA contains information about how a job should be carried out, types of risks and control measures.
  - ✓ Providers should carry out regular internal audits to check that the control measures for infection and other risks are being implemented. External bodies such as state and territory WHS authorities can also carry out audits to check that safety controls are appropriate.
- **Reactive strategies:** A reactive approach to risk identification involves reviewing accidents and incidents through measures such as report forms and data, as well as establishing consultation processes such as workplace health and safety committees (HSCs).



- ✓ Incident and accident report forms are filled out after any incident or accident. Data from these forms is used by HSCs, WHS officers and managers to identify hazards.
- ✓ Committees, team meetings and other forums give staff the chance to discuss infection control risks and provide suggestions for policy and procedure improvements.

#### 5.1.4. Carrying out a risk assessment

Once a hazard has been identified, you need to conduct an assessment of the risk of injury, harm or damage. An example of a risk is the likelihood of a hazard resulting in an injury or disease, together with the seriousness of the injury or disease.

The five steps in carrying out a risk assessment are shown here.

1. Evaluate the likelihood of an injury or illness occurring and the likely severity of any injury or illness
2. Review health and safety information relevant to the hazard such as incident reports, SDSs, results of workplace monitoring and inspections and supplier information
3. Identify factors that contribute to the risk such as the physical layout of the workplace, the knowledge, skills and experience of workers, and existing work practices
4. Identify actions necessary to eliminate or control the risk
5. Complete any relevant records

### 5.2. Identification of all hazards at the planning, design and evaluation stages

#### 5.1.5. Introduction

One of the essential elements of the health and safety management system is hazard identification. It is the foundation for developing safe work procedures, establishing prevention programs and making other precautions to eliminate or control the hazards.

A hazard is any source of potential damage, harm or adverse health effects on something or someone. Risk is the chance that a hazard will cause harm. Hazard identification process involves identifying both existing and potential workplace hazards, assessing the risks, determining and implementing the controls, and reviewing hazards.

Employers have the legal responsibility to identify and control, to the best of their ability, workplace hazards in order to protect workers. Likewise, workers have the right to know about the hazards of the job and how to protect themselves, and the responsibility to follow

Page 105 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

company rules that outline the hazard control processes. It is the responsibility of all workers to understand what a hazard is, what the risk is, how the hazards can affect people, property, and the environment, and how to prevent injury or illness from that hazard.

#### 5.1.6. When to identify hazards?

There are formal hazard assessments involving all workers before commencing work. Documentation from this should be reviewed as conditions change. There are informal hazard assessments that are ongoing and often undocumented, which consists of continuously scanning surroundings to be aware of condition changes.

It is an on-going process. You can identify hazards:

- During design and implementation
  - ✓ Designing new process
  - ✓ Purchasing and installing new machinery
- Before tasks are done
  - ✓ Using new equipment or processes
  - ✓ Each shift in hazardous environments
- During work
  - ✓ Be aware of changes, abnormal conditions, or sudden emissions
- After incidents
  - ✓ Near misses or minor events
  - ✓ Injuries

#### 5.1.7. Employer responsibilities

An employer has many responsibilities for hazard control under the legislation. These responsibilities include but are not limited to the following:

- Identify, assess, and properly control workplace hazards.
- Prepare a current list of known hazards in the workplace, including chemical and biological substances, physical agents, work design hazards, and any other risks.
- Maintain hazard identification and control lists as part of the health and safety management system.
- Develop written safe work practices and procedures.

- Inform workers about the hazards in the workplace.
- Train workers with regard to hazard assessment and required control measures to keep them safe at work.
- Ensure that an emergency response plan is developed for hazardous tasks.

While the current Saskatchewan legislation does not explicitly outline the steps for a hazard identification process, following these steps will help you accomplish the requirement:

- Identify hazards
- Assess the risk of the identified hazards using a risk assessment methodology
- Determine the appropriate controls
- Implement controls to address identified hazards, focusing on hazards with the greatest risk first, and considering:
  - ✓ hierarchy of controls: elimination/substitution, engineering, administrative (including safe work practices/procedures and training), PPE at the source, along the path, at the worker regulatory and other established standards.

**Activities that are considered to be High Hazard Work include:**

- Building construction
- Drilling for gas, oil and minerals
- Service for gas and oil wells and power tong service
- Logging
- Sawmilling
- Iron and steel processing and fabrication
- Road construction, earthwork, tunneling and trenching
- Local and provincial hauling and trucking
- Mining and smelting
- Exploration drilling, shaft sinking, quarrying and crushing of rocks
- Manufacturing of concrete block, brick, artificial stone and other clay and cement products
- Power line construction and maintenance.

It is important to check the regulations to determine if the activities that are being carried out by your employees have hazard identification requirements.

Page 107 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

Specific hazards or risks that the employer must address as per the Occupational Health and Safety Regulations, include:

- Musculoskeletal injuries
- Shift work
- Visually demanding tasks
- Exposure to infectious material or organism
- Full body harness
- Storage of materials
- Vehicular traffic
- Powered Mobile Equipment
- Transparent materials used in cabs
- Hoist crane, lifting device, or rigging

### 5.3. Developing and maintaining hazard risk control measures

#### 5.1.8. What Are Hazard Control Measures?

Control measures include actions that reduce risk from hazard exposure by removing the hazard or reducing exposure to it. Control measures also include substituting less hazardous materials, introducing physical barriers to the hazard, changing work processes to limit hazard exposure, and providing your workers with appropriate personal protective equipment (PPE).

Depending on the hazard and how often a worker is exposed to it, the risk of injury will vary. Likewise, control measures vary in effectiveness. Controls dependent on workers applying the control consistently are less successful, given the human tendency to forget. Conversely, controls independent of human action are most effective. The trick is choosing the most effective control measure that's feasible to implement while also considering its impact on your workflow.

#### 5.1.9. Steps of Hazard Control

The best way to prevent injuries or illness in your workplace is to find the hazards that could cause injury or illness, and fix them. Do this by following four simple steps:

- Spot the Hazard
- Assess the Risk
- Fix the Problem

Page 108 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- Evaluate Results

## **Involve your workers**

The workers using the equipment or chemicals, performing the tasks and being in the work environment every day are essential to help you identify hazards.

Don't underestimate your workers' input: they often have first-hand knowledge, experience and ideas about how to reduce safety risks, make improvements and find solutions.

When introducing any changes, make sure everyone knows what's being done and how you are controlling the hazards. Involving your workers in these ways reinforces the idea that safety is everyone's responsibility, and ensures you meet your requirements to consult with your workforce.

### **1. Spot the hazard**

A hazard is anything that has the potential to cause injury, illness or damage to your health. Hazards at work may include: manual tasks, untidy workplaces, bullying and violence, working at heights, faulty or unguarded machinery, chemicals, noise, poor work design (for example, tasks involving repetitive movements), inadequate management systems (for example, no procedures for performing tasks safely or for using personal protective equipment).

### **2. Fix the problem (Risk Control)**

You should always aim to remove a hazard completely from your workplace. Where this isn't practical, you should work through the other alternatives systematically.

Some problems may be fixed easily and straight away, while others will need more effort and planning. Concentrate on the most urgent hazards without neglecting the simpler ones that could be easily and immediately fixed. Some solutions are more effective than others. Make sure your solution does not introduce new hazards.

### **3. Evaluate the results**

After you think you've fixed the problem, find out whether the changes have been effective. Get feedback from those affected by the changes and include them in any modifications to their workplace or work routines. Look at your incident records to see if numbers are going down. Make sure your solution does not introduce new hazards. Maybe you and your workers can even see more ways to make further improvements. Set a date to re-assess the risk.

Page 109 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

Choose a timeframe appropriate to the task and the risk involved. If the work process changes, or new equipment is introduced to a task, then the risk assessment must be reviewed. During each of these four steps, employers, managers, contractors and workers need to communicate with each other and work together. Hazard management is not a one-off event — it's an ongoing process.

### 5.1.10. Hierarchy of controls

Use the hierarchy of controls to remove or reduce risk in your workplace. It starts with the most effective control method (removing the hazard from your workplace completely) and finishes with the least effective (wearing personal protective equipment/PPE).

You must use the highest-ranked control that is practical for controlling the risk. Only use lower-ranked controls as a last resort or until a more effective way of controlling risk can be used.

Sometimes using more than one control measure could be the most effective way to reduce the exposure to hazards.

Referee this video for control measure <https://youtu.be/oM-TjlvcgOU?t=12>.

#### A. Eliminate the hazard

Remove it completely from your workplace. For example: repair damaged equipment; outsource processes involving hazardous chemicals or equipment to a company set up to manage them safely. If this is not practical, then use the next one

#### B. Substitute the hazard

Replace it with a safer alternative. For example: use a less toxic chemical; lift smaller packages. If this is not practical, then use the next one

#### C. Isolate the hazard

Keep it away from workers as much as possible. For example: relocate photocopiers to separate, ventilated rooms; install barriers to restrict access to hazardous work areas. If this is not practical, then use the next.

#### D. Use engineering controls

Adapt tools or equipment to reduce the risk. For example: place guards on dangerous parts of machinery; use a trolley for moving heavy loads. If this is not practical, then use the next

Page 110 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

#### **E. Use administrative controls**

Change work practices and organization. For example, rotate jobs to reduce the time spent on any single work task; train staff in safe work procedures; carry out routine maintenance of equipment. If this is not practical, then use the next.

#### **F. Use personal protective equipment (PPE)**

For example: use hearing/eye protection equipment, hard hats, gloves and masks; train staff to use PPE correctly.

### **5.4. Identifying inadequacies in existing risk control measures**

Once your controls are implemented and employees have been trained to the required level, evaluation should take place to ensure that your control measures:

- Are effective
  - Safe to follow
  - Are introduced safely
  - Are reviewed to ensure that all hazards are identified
  - Have not been superseded with new work methods, equipment or chemicals to make the process safe
  - have been clearly communicate and taught to the workplace in terms of training and instruction
  - have been accurately understood so that workers are identifying and minimizing risk
- Other than the control measures that you put in place; further inadequacies can be identified through: Internal and external audits, Feedback from team members, Feedback from staff, Innovation, Changes to Work Health and Safety (WHS) legislation and Through the consultative process.

Even if the type of feedback is through unplanned contingencies, you should still consider the impact of the feedback and move to address it if the source of the feedback is credible. Document any and all changes you make to any of the problems identified. The most feasible change should be implemented and reasons why specific hierarchy controls are missed should be documented.

Changes that are introduced to a WHS cycle are intervention points. It is at these points that your organization may need assistance to your organization and those employed there.

Page 111 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

Different specialists will be able to assist with different interventions. For example, if changes to legislation require staff to be trained, you may require the services of a college or training organization for employees to obtain the skills they require.

## 5.5. Protocols for care following exposure to blood or other body fluids

### 5.1.11. Introduction

Definition: Blood borne Pathogen Exposure - a percutaneous injury (e.g., a needle stick or cut with a sharp object) or contact of mucous membrane or non-intact skin (e.g., exposed skin that is chapped, abraded, or afflicted with dermatitis) with blood, tissue, or other body fluids that are potentially infectious. In addition to blood and body fluids containing visible blood- semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, and amniotic fluid are also considered potentially infectious.

**Note:** Urine or gastric contents without visible blood are not considered potentially infectious.

Blood is the most infectious body fluid for the transmission of HIV, HBV and HCV. If the exposure incident involved a body fluid capable of transmitting any of the viruses (HIV, HBV or HCV Exposure to blood or body substances may be defined as direct contact with blood or other body substances through broken skin, mucous membranes (eyes, nose or mouth) or needle stick injury Health care workers (HCW) are at risk of acquiring infection through occupational exposure. Hospital employees can also transmit infections to patients and other employees.

Thus, an employee's health programmer must be in place to prevent and manage infections in hospital staff

### 5.1.12. Types of Occupational injuries

Occupational injury may be divided into Three:

- a) Percutaneous exposure (from needles, instruments, bone fragments, human bite which penetrates the skin layer, etc.);
  - b) Exposure via broken skin (exposed skin that is chapped, abraded, or afflicted with dermatitis etc.) with blood, tissue, or other body fluids that are potentially infectious;
- and

Page 112 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022



### c) Exposure via mucous membranes including the eye

Specific post-exposure policies must be developed, and compliance ensured for a number of infectious diseases for example: human immunodeficiency virus (HIV), viral hepatitis, severe acute respiratory syndrome (SARS), varicella, rubella and tuberculosis. Health care workers with infections should report their illnesses/incident to staff clinics for further evaluation and management.

Hepatitis B virus (HBV), hepatitis C virus (HCV) and the human immunodeficiency virus (HIV) constitute well-recognized occupational risks for healthcare workers (HCWs). Avoiding occupational blood exposure by the adherence to principles of standard precautions through the use of appropriate work practices and personal protective equipment is a cornerstone for preventing transmission of these blood-borne pathogens (BBP) in the health-care setting.

In general, the risk of viral transmission after a percutaneous injury is highest for HBV, followed by HCV and HIV. Occupational exposure is serious and every effort should be taken to prevent its occurrence. However, accidents may still happen and if so, risk assessment and counseling constitute the basis of post exposure management. Appropriate post exposure prophylaxis (PEP) should be provided using a case-by-case evaluation approach.

Each healthcare institution should have personnel responsible for the Sharps Prevention Program

## 5.5.3. Types of exposure

### I. Percutaneous Injury

Puncture or laceration of the skin that penetrates into or below the dermis. For the purposes of this protocol, a percutaneous exposure to blood/body fluids which has one or more of the following factors present will be defined as a more severe exposure Deep percutaneous injury.

- Visible blood present on the device associated with the exposure
- Exposure from a procedure which involved a needle placed directly into the Source's vein or artery
- Large-bore hollow needle
- A percutaneous exposure which has none of the above characteristics will be defined as a less severe exposure (e.g., superficial injury, no visible blood present on device)

Page 113 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

associated with the exposure, procedure from which exposure resulted did not involve a needle being placed directly into the Source's vein or artery, solid needle

## 2. Mucous Membrane and Non-intact Skin Exposures

- Mucous Membrane Exposure: When blood/body fluids come into contact with mucous membranes (e.g., eyes, oral cavity)
- Non-intact Skin Exposure: When blood/body fluids come into contact with an open wound or exposed skin that is chapped, abraded or non-intact because of dermatitis

A larger volume of blood/body fluid is associated with increased transmission risk for mucous membrane and non-intact skin exposures. For the purposes of this protocol, a mucous membrane or non-intact skin exposure involving a major splash of blood/body fluids will be defined as a large volume exposure. Exposures involving lesser amounts (e.g., only a few drops of fluid) will be defined as a small volume exposure.

## 3. Human Bites

Human bites may occur in both occupational and non-occupational settings. The person bitten has a potential percutaneous exposure and the person who was the biter has a potential mucous membrane exposure. Therefore, an individual who bites may be both the Source and Exposed in bite incidents.

- As HBV is present in saliva at concentrations 1,000 to 10,000 times less than in blood , for the purposes of post-exposure prophylaxis, generally only exposures to saliva containing visible blood would be considered for HBV PEP (such as deep bites associated with bleeding in the mouth of the biter.
- Exposures to Blood/Body Fluids Obtained Through Cuts, Nosebleeds, Physical Assaults, Sports Injuries

## 4. Consensual Sex (Sero-discordant Partners)

HBV and/or HIV PEP should be considered for the following unprotected (e.g., condom breakage) sexual exposures where the Source is known to be positive for the respective viruses. For example

The route of transmission for hepatitis B virus is through body substances such as blood and blood products, saliva, cerebrospinal fluid, peritoneal, pleural, pericardial and synovial fluid, amniotic fluid, semen and vaginal secretions and any other body fluid containing blood.

Page 114 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

The risk of a health care worker acquiring HIV after a needle stick or other “sharps” injury is less than 0.5%.

Risk reduction must be undertaken for all blood borne pathogens, including:

- adherence to standard precautions using personal protective equipment
- Appropriate use of safety devices and a needle disposal system to limit sharps exposure.
- Training for health care workers in safe sharps practice should be ongoing.
- Information on preventive measures must be provided to all staff with potential exposure to blood and blood products.
- Policies which are in keeping with the local and national guidelines must include
  - ✓ screening of patients
  - ✓ disposal of sharps and wastes
  - ✓ protective clothing
  - ✓ managing inoculation accidents
  - ✓ sterilization and disinfection.

Hospital policy must include measures to obtain serological testing of source patients promptly where necessary, usually with the patient’s informed consent. Post exposure prophylaxis should be started as per local or national guidelines. In case of hepatitis B, immunization is the best way of preventing transmission to health care staff.

- ✓ All HCWs at risk must be vaccinated.
- ✓ Staff infected with blood-borne pathogens may transmit these infections to patients and require careful evaluation with respect to their duties. This status should not be used as cause for discrimination

#### 5.5.4. Exposures for which PEP is indicated

- Break in the skin by a sharp object (including hollow-bore, solid-bore, and cutting needles or broken glassware) that is contaminated with blood, visibly bloody fluid, or other potentially infectious material, or sharp objects had been in the source patient's blood vessel.
- Bite from a patient with visible bleeding (in the mouth) and which causes bleeding in the exposed worker.

Page 115 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- Splash of blood, visibly bloody fluid, or other potentially infectious material to a mucosal surface (mouth, nose, or eyes).

Remember, Health care workers should have immediate access to post exposure prophylaxis (PEP) , 24 hours a day, 7 days a week to be freely dispensed by any hospital (private or public), regardless of the location or type of work they do. The minimum care following potential exposure to HIV should be risk assessment and, if deemed necessary, the first dose of PEP medication

#### 5.3.4. General procedures

First Aid – when an exposure incident occurs, implement first aid

- Following any exposure, the wound should be washed immediately and thoroughly with soap and water, flush the eyes with running water immediately following a bodily fluid splash. Alcohol, hydrogen peroxide, Betadine or other chemical cleansers are best avoided. Wound should not be squeezed or sucked.
- For mucosal contact e.g. spillage into the conjunctivae, the exposed area should be immediately flushed with plenty of clean running water.
- The exposed HCW is responsible for reporting the exposure incident to his/her supervisor and should then seek immediate medical advice for proper wound care and post-exposure management.
- The following information should be recorded in the exposed worker's confidential medical record:
  - ✓ details about the source patient (e.g. name, NRIC No, diagnosis and any relevant information)
  - ✓ date, time and place of the exposure
  - ✓ details of the procedure being performed
  - ✓ use of protective equipment at the time of the exposure
  - ✓ the type, severity, and amount of fluid to which the worker was exposed
- The health care worker should be tested for HIV antibody, HCV, HBV antigen and antibody.
- The source patient's blood (if available) should be tested for HIV, HCV & HBV

Page 116 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

**Reporting** All institutions should have a mechanism in place for reporting and managing of sharp injuries and mucosal exposure in the occupational setting. HCWs must know the reporting process to facilitate quick and smooth flow so as to allow the attending physician to evaluate the risk of exposure and provide prompt appropriate post exposure treatment

**Counseling:** Until the risk of infection is ruled out, advice should be given to the exposed staff to refrain from donating blood, plasma, organs, tissue or semen. The use of condom during sexual intercourse should also be advised.

Page 117 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

## Self-check-5

**Directions:** Answer all the questions listed below.

Part I: write “True” if the statement is correct or “False” if the statement is incorrect

1. The workers using the equipment or chemicals, performing the tasks and being in the work environment every day are essential to help you identify hazards.
2. Urine or gastric contents without visible blood are not considered potentially infectious

Part II: choose the correct answer among the alternatives for the following multiple choice questions

1. Puncture or laceration of the skin that penetrates into or below the dermis \_\_\_\_ type of exposure
  - A. Percutaneous Injury
  - B. Mucus membrane exposure
  - C. Human bite
  - D. Consensual Sex
2. Use a less toxic chemical; lift smaller packages is \_\_\_\_\_ type hazard control hierarchy
  - A. Eliminate the hazard
  - B. Substitute the hazard
  - C. Isolate the hazard
  - D. Use engineering controls

Part III: write correct and short answer for the following essay item questions

1. List the four simple steps of hazard control
2. List and explain types of occupational injuries

## Unit Six: Establish and Maintain Participative Measures

This learning unit is developed to provide the trainees the necessary information regarding the following content coverage and topics:

- Participative processes in accordance with occupational health and safety (OHS) legislative regulations and standards.
- Dealing with Issues of participation and consultation
- Providing Information about the outcomes of participation and consultation
- Establishing and monitoring Systems for keeping OHS records

This unit will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Ensure Participative processes in accordance with OHS legislation, regulations and standards
- Deal with Issues of participation and consultation
- Provide Information about the outcomes of participation and consultation
- Establish and monitoring Systems for keeping OHS records

### Learning Instruction

- ✓ Read the specific objectives of this Learning Guide.
- ✓ Read the information written in the information
- ✓ Accomplish the “Self-check 6”

## 6.1. Participative processes in accordance OHS legislation, regulations, and standards

### 6.1.1. Introduction

Effective IPC requires constant action at all levels of the health system, including policymakers, facility managers, health workers and those who access health services.

OHS legislation requires employers to establish and maintain participative arrangements with their employees. Participative arrangements and consultative mechanisms include the following types of activities that are critical for the effective management of OHS in an organization:

- OHS representatives work with the employer and employees to represent groups or employees in relation to OHS.
- OHS committees are used as part of the consultation and participative processes within the organization
- OHS meetings are used to facilitate consultation and to maintain OHS at the forefront of both the employer and employee areas of focus.
- OHS audits are undertaken to confirm the effectiveness of the OHS system within the organization and to highlight areas needing attention or improvement.
- OHS reporting and feedback processes are needed to ensure that employee issues can be recorded and resolved within the appropriate policy framework of the organization

## 6.2. Participative arrangement

The areas in which employees must be consulted about include the following aspects related to OHS:

- The identification and assessment of hazards and risks
- Decisions regarding the control of risks
- Decisions regarding employees' facilities
- Any changes proposed by the employer that may impact on OHS
- Decisions regarding the policies and procedures for the resolution of OHS issues, consultation processes for monitoring activities for OHS purposes and for providing information and training for OHS.
- Decisions regarding the membership of any OHS committee.

Page 120 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022



In the context of OHS legislation, employers need to consult with employees via a process that includes the following critical steps

1. Information needs to be shared with employees
2. Employees must be given reasonable time and opportunity to provide feedback
3. Employers must take any feedback into consideration

The mechanisms and processes via which consultation is to be achieved must be agreed on by the organization and the employees, and then they must be complied with. Consultation must enable a two-way process between the employer and the employees, and must acknowledge the diversity of employees within the workplace (must consider any special needs, language issues, disabilities, disabilities, cultural requirements, etc.).

OHS information can be provided by via regular meetings, OHS committees, team briefings, and other such employee forums. These may be supported by the production of OHS communication packages and the availability of information on an organization's intranet.

### **6.3. Dealing with Issues of participation and consultation**

#### **6.3.1. Dealing with Issue with participation**

There are a number of approaches towards issue resolution in the workplace. The most effective process is one that includes steps to enable the organization to research and analyses the issue, determine the best possible or most appropriate solution and then implement the most appropriate solution to address and resolve the issue. Generally, there are 7 main steps involved in issue resolution:

- Identify the issue and the problem or impact that is being caused by the issue
- Agree on what is expected to happen to resolve the issue
- Research and analyses the issue to determine its cause
- Look for solutions to the issue and generate alternative possible solutions
- Evaluate the alternatives and determine the best solution that will resolve the issue
- Take action to implement the resolution
- Monitor the outcome and results of the resolution evaluate if the resolution has been effective and successful.

Using a systematic process like this enables the management of an organization to involve employees in the resolution process.

#### 6.4. Dealing with Issue with Consultation

Processes of consultation form an integral part of any organization's approach to OHS. The consultative arrangements need to be devised so they include the needs of the organization and the employees of the organization. In very small organizations, consultation may occur on a day-to-day, somewhat informal, basis as part of the operations of the business. In more complex or larger organizations, it may be necessary to utilize more formal arrangements to support consultation in the workplace between the employer and the employees of the organization.

The mechanisms and processes via which consultation is to be achieved must be agreed on by the organization and the employees, and then they must be complied with. Consultation must enable a two-way process between the employer and the employees, and must acknowledge the diversity of employees within the workplace (must consider any special needs, language issues, disabilities, disabilities, cultural requirements, etc.).

#### 6.5. Employee Engagement

Participative arrangements and consultation are the mechanisms that provide critical support for the organization's OHS system. Using these mechanisms in conjunction with formal processes to manage issues enables the organization to resolve issues in a responsive and positive way. The value of involving employees in activities and decisions that directly affect them is proven by the benefits it provides to both the organization and the individual employees in the context of cooperation and collaboration. Involving employees may also encourage them to be more creative and forward thinking in their approach to the resolution of OHS issues. People may be inspired and feel empowered to contribute ideas that fall outside of the traditional norms of the organization. Gathering, assessing and using creative ideas can result in the organization being able to implement innovative solutions that not only resolve issues that have been raised, but may actually enhance the effectiveness of the overall OHS system.

## 6.6. Providing Information about the outcomes of participation and consultation

Information may be distributed directly to employees on an individual basis and should also be displayed in the workplace. Within the overall processes to achieve effective communication with employees, there must be a capability for feedback processes to be initiated and supported. Employees must be able to express their views and ask questions of any communications that are provided by the organization.

In order to confirm that communication within an organization about OHS is effective, there must be some methods of follow up and evaluation used by the organization. Due to the critical obligations of employers with regards to OHS and the associated need for consultation and participative arrangements, employers need and want to ensure that the right information is being communicated and that all employees can access and understand the information.

The forums or meetings that form part of the participative arrangements and consultation within the organization for OHS need to be recorded and documented via the production of meeting agendas and minutes.

Agendas for meetings need to detail the following information:

- Date, time and venue of the meeting
- Expected attendees
- Agenda items to be addressed and the time of each topic
- Nominee who will lead or present each agenda item
- Any preparation that attendees need to complete prior to the meeting.

The minutes of meetings need to detail the following information:

- Date, time and venue of the meeting
- Chairperson details
- Agenda items that were addressed
- Details and outcomes of any discussions at the meeting
- Actions and timeframes associated with the agenda items
- Any attachments such as reports that were used as reference in the meeting.

Page 123 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

Formally recording the meetings for OHS that take place within the organization ensure that the organization can build records and evidence of the consultation and participative arrangements that are occurring between the organization and its employees. This also enables the organization to monitor and track the progress of actions related to OHS activities

**Communication of Information** In all organizations, employees have an expectation that they will be communicated with regarding the outcome of participative arrangements and consultation that exist to support the OHS system. Under legislation, employers have a responsibility to inform their employees of OHS requirements and safety information, and to convey their expectations of employees with regards to OHS. Employers should establish regular meetings with employees to inform them of OHS and promote their understanding of the OHS system, and how it operates in the workplace.

The guidelines for the consultation and participative arrangements with employees will be provided in the OHS policy of the organization. OHS information needs to be available to all employees and communicated to all levels of the organization. The key is that the organization needs to ensure that the information is communicated in a clear and simple way. The organization will have to determine and agree on the most appropriate and effective means of communicating with their employees about OHS. There are a number of methods that are effective in achieving this:

- Policies and procedures manuals
- Organizational intranet information updates
- Newsletters
- Training sessions
- Information flyers
- Booklets
- Regular team or department meetings.

OHS information can be provided by via

- regular meetings
- OHS committees

Page 124 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- team briefings and other such employee forum

## 6.7. Establish and monitoring Systems for keeping OHS records

### 6.7.1. Monitoring in the work place

#### General principles:

- Employers should monitor and record the exposure of workers to hazardous chemicals to ensure their safety and health. They should ensure that workers are not exposed to chemicals to an extent which exceeds exposure limits or other exposure criteria for the evaluation and control of the working environment. Based on the monitoring data, employers should assess the exposure of workers to hazardous chemicals.
- Airborne concentrations of hazardous chemicals should be measured in all places of work where this is necessary to ensure the safety and health of workers against inhalation risks.
- Measurements of airborne contaminants are necessary if other techniques do not suffice to provide a valid estimate of the risk of exposure and to assess the existing control measures.
- Techniques for this risk assessment may include the following: information on the intrinsic health and physical hazards, obtained from the chemical safety data sheets; estimation of exposure based on the method of work and work pattern; advice from the supplier; experience of exposure in the workplace or of other users; and simple qualitative tests.

#### Measuring methods

- Sampling equipment should be compatible with the analytical methods available and should have been validated over a suitable range of concentrations above and below the exposure limits or other exposure criteria in accordance with published national or international standards. where they exist.
- Static monitoring should be used to determine the distribution of an airborne chemical throughout the general atmosphere of the working area and to identify problems and priorities. Air samples should be taken:

- ✓ close to sources of emission in order to evaluate concentrations or the standard of engineering controls;

Page 125 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- ✓ at various places in the working area to assess the extent of the chemical's general distribution; and
- ✓ from working areas which represent typical exposure.
- Personal monitoring should be used to evaluate the risk of exposure to the individual worker. Air samples should be collected in the workers breathing zone by means of personal samplers. Sampling should be carried out while the work activity is in operating.
- Where concentrations vary from one work operation or phase to another, personal sampling should be done in such a manner that the averages and in any case the maximum, level of exposure of each individual worker can be determined.
- Personal sampling should measure exposure, or allow assessment of exposure throughout the work shift. The exposure should be compared to occupational exposure limit values, which are usually quoted for an eight-hour period or, for short-term limits, 15 minutes. The measurement may be continuous over the whole shift or intermittent, so long as this allows a valid calculation of the average exposure and where necessary is supplemented by short-term sampling during periods of peak emission.
- Exposure profiles of particular jobs or occupational categories should be constructed from the air-sampling data of different operations and from the workers' exposure time in these jobs.

### Monitoring strategy

- Where a systematic measurement programme has been decided, it should evaluate whether the exposure of workers to certain hazardous chemicals prescribed by the competent authority or determined by the initial assessment is being kept under control. The aims of this programme should be:
  - ✓ to ensure that the health of the workers is efficiently protected;
  - ✓ to ensure that the preventive actions which have been taken are still effective;
  - ✓ to ensure that the levels, as measured previously, remain unchanged or fall;
  - ✓ to ensure that any changes made in manufacturing processes or work practices will not lead to an excessive exposure to hazardous chemicals;
  - ✓ to promote the implementation of more efficient preventive measures.

Page 126 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1 April, 2022
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- The monitoring of airborne concentrations of chemicals in the working environment should be performed only by skilled personnel with adequate equipment and technical training.
- The employer should arrange for regular inspection, maintenance and calibration of the measuring equipment.
- The service responsible for monitoring the working environment should be kept informed about any change in plant, equipment, process, materials or work practices likely to bring about any substantial alteration in levels of exposure to hazardous chemicals.

### **Record keeping**

- Records should be kept by employers on measurements of airborne hazardous chemicals. Such records should be clearly marked by date, work area and plant location.
- Personal sampling measurements, including the exposures calculated, should be recorded.
- The workers and their representatives, and the competent authority, should have access to these records.
- Besides the numerical results of measurements, the monitoring data should include, for example:
  - ✓ the marking of the hazardous chemical;
  - ✓ the location, nature, dimensions and other distinctive features of the workplace where static measurements were made; the exact location at which personal monitoring measurements were made, and the names and job titles of the workers involved;
  - ✓ the source or sources of airborne emissions, their location and the type of work and operations being performed during sampling;
  - ✓ relevant information on the functioning of the process, engineering controls, ventilation and weather conditions with respect to the emissions;
  - ✓ the sampling instrument used, its accessories and the method of analysis;
  - ✓ the date and exact time of sampling;

Page 127 of 132	Ministry of Labor and Skills Author/Copyright	Health Information System Level -4	Version -1
			April, 2022

- ✓ the duration of the workers' exposure, the use or non-use of respiratory protection and other comments relating to the exposure evaluation;
- ✓ the names of the persons responsible for the sampling and for the analytical determinations.
- Records should be kept for a period of time determined by the competent authority. Where this has not been prescribed, it is recommended that the employer keep the records, or a suitable summary, for:
  - ✓ at least 30 years where the record is representative of the personal exposures of identifiable employees;
  - ✓ at least five years in all other cases.

Record keeping is very crucial in occupational health and safety because evidence is required for different purpose. Activity not recorded are not dome. For this topic, we use Occupational Safety and Health Administration (OSHA) record keeping process which is part of the United States department of labor.

For recordkeeping purposes, an employee's routine functions are those work activities the employee regularly performs at least once per week. A recommended work restriction is recordable only if it affects one or more of the employee's routine job functions. To determine whether this is the case, you must evaluate the restriction in light of the routine functions of the injured or ill employee's job. A partial day of work is recorded as a day of job transfer or restriction for recordkeeping purposes, except for the day on which the injury occurred or the illness began.

When to record travel, three situations in which injuries or illnesses sustained by traveling employees are not considered work-related for OSHA recordkeeping purposes

- Injuries and illnesses that occur at home are generally not considered work related. However, when a traveling employee checks into a hotel, motel, or other temporary residence, just as an employer may sometimes be required to record an injury or illness occurring to an employee working in his or her home.



- Second, if an employee has established a "home away from home" and is reporting to a fixed worksite each day, the employer does not consider injuries or illnesses work-related
- if they occur while the employee is commuting between the temporary residence and the job location.
- Third, the employer is not required to consider an injury or illness to be work-related if it occurs while the employee is on a personal detour from the route of business travel.

## Self-check-6

**Directions:** Answer all the questions listed below.

Part I: write “True” if the statement is correct or “False” if the statement is incorrect

1. Employers should monitor and record the exposure of workers to hazardous chemicals to ensure their safety and health.
2. Employer should arrange for regular inspection, maintenance and calibration of the measuring equipment.

Part II: choose the correct answer among the alternatives for the following multiple choice questions

1. The areas in which employees must be consulted about include the following aspects related to OHS:
  - A. The identification and assessment of hazards and risks
  - B. Decisions regarding the control of risks
  - C. Decisions regarding employees’ facilities
  - D. Any changes proposed by the employer that may impact on OHS
  - E. All
2. Employer keep the records, or a suitable summary, for: at least \_\_\_\_ years where the record is representative of the personal exposures of identifiable employees;
  - A. 5 years
  - B. 10 years
  - C. 15 years
  - D. 30 years

**Part III write correct and short answer for the following essay item questions**

1. List the components in step in the context of OHS legislation where employers need to consult with employees
2. Explain the general principles monitoring work place

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