STUDY MODULE- X

Water Chemistry

(Occupational Health, Safety and Environment)

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1 Introduction

Occupational Health and Safety is to introduce students to occupational health and safety principles as they prepare to enter the workplace. Students learn the required skills, knowledge and attitudes in problem-solving and decision making regarding their occupational health and safety and that of others. Occupational health and safety is an evolving discipline that requires 21st century workers to be constantly learning new skills and knowledge as a lifelong learner to manage the technological changes in workplace processes. Incorporating occupational health and safety principles into all aspects of work and the workplace is a fundamental step in the working process. Occupational Health and Safety is grounded in knowledge and concepts from various disciplines, including science and health sciences, technology, social studies and psychology. Many OH&S practices and procedures in current workplaces have been developed by a multi-discipline team approach where the workplace is examined to determine the most appropriate controls for workers. Controls are the activities and processes that employers use to eliminate hazards or reduce risk to workers. Education and training on how to properly use these controls is critical to working in a safe and healthy manner. occupational health deals with all aspects of health and safety in the workplace and has a strong focus on primary prevention of hazards.

The main focus in occupational health is on three different objectives:

(i) the maintenance and promotion of workers' health and working capacity;
(ii) the improvement of working environment and work to become conducive to safety and health and
(iii) Development of work organizations and working cultures in a direction which supports health and safety at work and in doing so also promotes a positive social climate and smooth operation and may enhance productivity of the undertakings.

In Pakistan many employees are working in laboratories such as pharmaceuticals laboratories, hospitals laboratories and other chemical and food laboratories. The laboratory environment can be a hazardous place to work. Laboratory workers are exposed to numerous potential hazards including chemical, biological, physical and radioactive hazards, as well as musculoskeletal stresses. Laboratory safety is governed by numerous local, state and federal regulations. Over the years, OSHA has promulgated rules and published guidance to make laboratories increasingly safe for personnel. This document is intended for supervisors, principal investigators and managers who have the primary responsibility for maintaining laboratories under their supervision as safe, healthy places to work and for ensuring that applicable health, safety and environmental regulations are followed. Worker guidance in the form of Fact Sheets and QuickCards is also provided for certain hazards that may be encountered in laboratories. This document is designed to make employers aware of the OSHA

standards as well as OSHA guidance that is available to protect workers from the diverse hazards encountered in laboratories. The extent of detail on specific hazards provided in this document is dependent on the nature of each hazard and its importance in a laboratory setting. In addition to information on OSHA standards and guidance that deal with laboratory hazards, appendices are provided with information on other governmental and non-governmental agencies that deal with various aspects of laboratory safety. The concept of working culture is intended in this context to mean a reflection of the essential value systems adopted by the undertaking concerned. Such a culture is reflected in practice in the managerial systems, personnel policy, principles for participation, training policies and quality management of the undertaking.

This course will give students the opportunity to interact and practice to problem solves and make decisions on the most appropriate control for identified workplace conditions. The four units are.

1.1 Course Objectives

1. Objective of this course is to provide HSE skilled workforce specially to the workers of laboratories.
2. Workforce produced by this training would help to reduce unemployment and poverty in the society.
3. This training course is designed to create job opportunities.
4. Further, this Curriculum is developed by considering the requirements of local market and need of the trade enabling the pass-outs to meet the job market.
5. Provide technical and vocational training which reflects the requirements of the local Marble sector.

1.2 Competencies gained after completion of the course

After completion of this course, the student should be able to:

1. Explain all safety & health hazards involved during working in the laboratory sector.
2. Explain the personal protective equipment (PPE's) & its importance.
3. Enhancement of efficiency in an organized workshop.
4. Elaborate the possible work and health hazard at work place.
5. Describe the importance of First aid in the laboratory.
6. Explain the first aid method during the emergency.
7. Elaborate the permit to work system (PTW).

8. Elaborate the safety measures on all work places.
9. Describe the types of fire &their preventive measures.
10. Elaborate the hazards associated with lifting equipments & chemical reagents.
11. Explain the pollution (water/solid) & its effect on the surrounding environment.
12. Elaborate the concept of quality to achieve maximum satisfaction.
13. Describe the importance of HSE training of employees.
14. Apply all safety precautions.
15. Handle the various equipments/glass wares with safety.
16. Understand the accident & prevention measure from the accident.
17. Use the fire extinguishers.
18. Understand the safe handling of lifting equipment& lifting operations.
19. Make safe procedures to handle the pollution & understand its effect on surrounding.
20. Communicate with the related persons in the laboratory.
21. Apply basic concept of quality control & its importance in laboratory sector to achieve the best results.

1.3 Some Important Definitions

Occupation is your job or the way you spend your time, An **example of occupation** is when you are a doctor or a lawyer, factory worker or working in a hospital or a laboratory

Health has been defined as "a state of complete physical, mental and social well-being and not merely the absence of disease. Occupational health is a multidisciplinary field

Employee: a person employed under a contract of employment or contracts of training. Unless otherwise stated the term “employee/s” relates to direct and on-hired employees.

Hazard: a source or situation with a potential to cause injury, illness or disease.

Hazard identification: the process of recognising that a hazard exists and defining its characteristics. **HSR:** Health and Safety Representative (employee elected to represent employees of a designated workgroup) Near miss: potentially significant event that did not occur due to prevailing conditions, but could have resulted from a sequence of events that did occur.

Risk: the likelihood of an injury, illness or disease occurring

Safety

Occupational Health

Occupational Safety

Environment

Hazards

International Labour Organization (ILO)

the World Health Organization (WHO)

Injury Injury, also known as physical trauma, is damage to the body caused by external force.[1] This may be caused by accidents, falls, hits, weapons, and other causes

2 Personal Safety

2.1 Personal Protective Equipment (PPE)

Personal protective equipment is intended to protect users from serious injuries or illness coming about because of contact with chemicals, physical risks. Some jobs have a certain element of risk associated with them (e.g. working in areas of excessive noise or in areas where flying objects may occur). Where this is the case, personal protective equipment will be provided by the client, except for wet weather gear which is your responsibility. Wearing PPE reduces the risk of injury. It is your responsibility to wear this equipment when and where required. The client will explain the rules about protective equipment to you and should display PPE signage in areas where it must be worn. You will be required to observe and follow these rules.

2.2 Face and Eye Protection

Face and eye protection may be required for certain jobs or work areas. It is important that you wear this protection to prevent serious eye injuries. You will be told where eye protection is required and the type of protection to be worn. The client must display signage in areas where eye protection is to be worn.

Safety glasses	Splash goggles	Laser goggles	Face shields
Safety glasses provide eye protection from moderate impact and particles associated with grinding, sawing, scaling, broken glass, and minor chemical splashes, etc.	Splash goggles provide adequate eye protection from many hazards, including potential chemical splash hazards, use of concentrated corrosive material, and bulk chemical transfer.	The lens of the eyewear is a filter/absorber designed to reduce light transmittance of a specific wavelength. The lens can filter out a specific wavelength while maintaining adequate light transmission for other wavelengths.	Face shields provide additional protection to the eyes and face when used in combination with safety glasses or splash goggles. Face shields consist of an adjustable headgear and face shield of tinted or clear lenses or a mesh wire screen.
			

(Images courtesy of Egebant)
Adopted from Cornell University Environmental Health & Safety Department.

2.2.1 Using Contact Lenses

In the event of chemical accident to the eyes, there could be some protection but, on the other hand, the presence of the lens would be an impediment to prompt and through flushing of the eye. The lens would have to be removed which might result in damage to the eye in itself. It, however, the wearer of the contact lens conscientiously wear a good –quality pair at all times when there is possibility of an ancident occurring, there is probably little risk in wearing contact lens.

2.2.2 Safety Glasses

Safety glasses provide eye protection from moderate effect and particles connected with grinding, sawing, scaling, broken glass, and minor chemical splashes, and so forth. Side defenders are required when there is a risk from flying items. In prescription from those people requiring corrective lenses, safety glasses are accessible. In the case of safety glasses don't give sufficient insurance to procedures that include substantial synthetic utilize, such as, blending, pouring, or blending, splash goggles should be utilized.

2.2.3 Splash Goggles

Potential chemicals splash hazards, utilization of concentrated corrosive material, and bulk chemical transfer splash goggles give satisfactory eye protection from numerous dangers. Goggles are available with clear or tinted lenses, fog proofing, and vented frames. Be aware those goggles intended for carpentry are not fitting for working with chemicals. In the event of splash, chemicals could enter into these small holes throughout the face are not fitting for working for working with chemicals. In the event of a splash, chemicals could enter into these small holes, and results in a chemical exposure to face. Ensure the goggles you pick are evaluated for use with chemicals.

2.2.4 Laser goggles

The lens of the eyewear is a filter/absorber designed to reduce light transmittance of a specific wavelength. The lens can filter out a specific wavelength while maintaining adequate light transmission for other wavelengths

2.3 Hearing Protection

Hearing protection must be worn whenever the noise level exceeds the noise exposure standard and the client has implemented hearing protection as a control. You will be told if hearing protection is required. You must wear this protection at all times in designated areas to protect your hearing and to protect you from noise induced hearing loss. As an employee the client must provide you with periodic hearing tests and audiometric testing (if required).

2.4 Foot Protection

Safety boots or shoes must be worn in designated areas to protect your feet from falling objects. If you are unable to wear your safety footwear for any reason, you must notify your Consultant. You are to provide a medical certificate specifying that you are unable to wear safety footwear.

2.5 Head protection

Accident that causes head injuries are difficult to anticipate or control. If hazards exist could cause head injury, employees should try to eliminate the hazards, but they should also wear head protection. Safety hats protect the head from impact, protection and electrical shock. Head protection is necessary if you work where there is a risk of injury from moving, flying objects or if you work near high-voltage equipment

Figure 3.1 Head cover
(Courtesy of Egebant)

2.6 Hand Protection

Most accidents involving hands and arms can be classified under four main hazards categories

- Chemicals
- Abrasions
- Cuts
- Heat/Cold

There are several types of gloves that provide protection against and opposes corruption and pervasion to chemicals. Confiding in the type concentration of chemical, performance characteristics of the gloves, conditions and duration of use, hazards present, and the duration of time a chemical has been in contact with the glove, all must be replaced periodically.

Gloves must be worn at any potential danger like chemicals, cuts, lacerations, punctures, burn (heat/cold), biological materials, or harmfull temperature extremes and when utilizing chemicals that are easily ingested through the skin and/or particularly hazardous. The correct utilization of hand protection can shield from potential chemical and physical hazards.

2.6.1 Types of gloves

Table 3.3 Types of gloves		
Latex gloves	Resistant to ketones, alcohols, caustics, and organic acids.	
Nitrile gloves	Resistant to alcohols, caustics, organic acids, and some ketones.	
Cryogenic gloves	Cryogenic gloves are used to protect hands from extremely cold temperatures.	
PVA Gloves	Resistant to chlorinated solvents, petroleum solvents, and aromatics.	
Cut-resistant gloves	Cut resistant gloves are gloves designed to protect the wearer's hands from cuts while working with sharp tools.	
Heat-resistant gloves	Working with metal and glass forming and hot surfaces requires gloves that offer the highest level of protection against the multiple hazards of a high-heat workplace.	

2.7 Protective Clothing

Loose or torn clothing should be avoided without wearing a lab coat because of the ignition, absorption, and entanglement in machinery risks.

Dangling jewellery, finger rings or other tight jewellery and excessively log hair should also be avoided.

2.7.1 Lab Coats

- Lab coats provide protection of skin and personal clothing from incidental contact and small splashes.
- Prevent the spread of contaminations outside the lab (provided they are not worn outside the Lab).
- Provide a removable barrier in the event of an incident involving a spill or splash of hazardous substances.

There are no design or test criteria specified in regulations or guidelines specific to lab coats. What this mean is

- Lab coat are not tested for normal conditions that may be experienced in a research lab with respect to chemical use, or joined research activities.
- Manufacturers of the lab coats do not provide information about the capability of a lab coat for a combination of hazards. If a coat is “flame resistant”, it may not be chemical resistant or acid resistant.
- If a coat is sold as flame resistant, this means it is not tested involving flammable chemicals on the coat. The flame resistance test criteria includes simulation of the possibilities of a flash fire, or electric are flash, not a chemical fire. “Flame resistant” term refers to the characteristic of a fabric that avoids burning in air.

Lab coat should be provided for protection and convenience. They should be worn at all times in the lab areas. Due to the possible absorption and accumulation of chemicals in the material, lab coats should not be worn in the lunchroom or elsewhere outside the laboratory.

2.8 Other Specific Protection

Other types of protective equipment may be required, depending on the work you are doing. These may include spats, aprons, gloves (not to be worn near moving machinery), helmets, etc. You will be advised of any other protective equipment required and whether specific training is required in the use of this equipment. For your added protection, gloves, loose clothing, neck ties, bulky rings, and dangling jewellery must not be worn when working with or near moving machinery. Long hair should be tied back or enclosed in a hair net.

3 laboratory Safety

One of the major concerns of any worker is to be safe while on the job. Both from the aspect of personal safety and from the aspect of liability for employees, the concern is justified. Many areas of wastewater treatment involve certain potential hazards and the analytical laboratory is certainly no exception. The key to job safety in spite of this is the recognition of the hazards involved in laboratory work, an understanding of what can be done to reduce the risk of having an accident, and knowing the proper responses to accidents that may occur.

The following list contains seven of the most common hazards and types of dangerous materials associated with working in a laboratory which handles wastewater samples, and includes some suggestions for steps which may be taken to help prevent an accident from occurring. The list does not include all possible situations which may arise; many types of hazards may be specific to a particular facility or type of process. Infectious Materials:

Even a small amount of wastewater or sludge contains millions of microorganisms; some of them may be disease causing. Diseases such as tetanus, typhoid, dysentery, and hepatitis may be contracted through improper handling of wastewater samples.

The table below lists examples of the numerous diseases associated with wastewater contaminated environments.

3.1 Diseases Associated with Wastewater Contaminated Environments

Disease	Organism	Mode Of Transmission
Bacillary dysentery Asiatic cholera Typhoid fever Tuberculosis Tetanus Infectious hepatitis Poliomyelitis Common cold[a] Hookworm disease Histoplasmosis	Shigella spp. Vibrio cholerae Salmonella Typhi Mycobacterium tuberculosis Clostridium tetani Hepatitis A virus Poliovirus Echovirus Necator americanus Ancylostoma duodenale Histoplasma capsulatum	Ingestion[b] Ingestion Ingestion Inhalation[c] Wound contact Ingestion Ingestion Inhalation Skin contact Inhalation

[a]The common cold is usually associated with various rhinovirus types, several coronaviruses, and some unknown viruses.

[b]Inhalation is by way of mouth and nose and taken through the lungs and into the bloodstream.

[c]Ingestion is by way of mouth or nose and taken in through the stomach and intestine and into the bloodstream.

An important means of protection against infection is to receive the appropriate inoculations. Your local health officials and personal physician should be consulted as to what inoculation may be needed.

Probably the most obvious means of protection is to observe good personal hygiene, including thorough washing of hands and face, changing clothes before leaving work, and the use of protective clothing such as gloves and aprons where warranted. The analyst must always use a pipet bulb in the wastewater lab, and make the assumption that all glassware and samples are contaminated. Special precautions should be taken when working with cuts or scrapes on the hands. There should be no eating, drinking, or smoking in the lab area, and food and drink should never be stored in the same area as samples and reagents.

3.2 Poisons

Many of the chemicals commonly used in the lab are deadly poisons. Some of these such as carbon tetrachloride or mercury can be absorbed through the skin and may build up over a long period of time to dangerous levels. Others such as cyanide

may take on a gaseous form that is extremely dangerous when breathed in.

Warning labels on chemicals used should be read and understood. If the chemical being used is poisonous, special care should be taken to assure that the material will not be ingested or absorbed through the skin. All such reagents should be clearly labeled as to its poisonous nature.

3.3 Explosive Materials

Almost all labs use acetone, azide compounds, and many other explosive chemicals. Other chemicals which may not be explosive alone may form explosive compounds with other non-explosive chemicals. Heat, an electric spark, sudden shock, pressure, or even contact with air may trigger an explosion from some compounds.

Whenever explosive solvents such as ether or acetone are being used in the lab, open flames must not be used. Procedures using these chemicals should be carried

out in the fume hood, if possible, with the fan on. If sample digestions involve the use of perchloric acid, an explosion proof fume hood rated for perchloric acid must be used. Analytical procedures must be followed exactly as written using the chemicals specified. Substitutions of chemicals or alterations in the procedures may cause dangerous reactions to occur.

3.4 Electrical Shock

This usually occurs due to improper grounding of instrumentation or improper contact between the analyst, electricity, and water.

Make sure that any instrument is grounded before use. Avoid using electrical

instrumentation near sinks or other sources of water. Do not operate electrical instruments while standing in water. If an instrument does get wet do not use it until it has been dried out and has been determined safe for use. Do not have electrical outlets placed near sinks. All permanent wiring should be installed by a qualified electrician. Do not overload electrical circuits in the lab. Know the location of circuit breaker boxes that control circuits in the lab and have the breakers clearly marked.

3.4.1 Toxic Fumes

These are generated as part of many routine procedures. An example of this is the generation of sulfur trioxide fumes during the analysis for total Kjeldahl nitrogen.

This becomes dangerous when a properly operating fume hood is not used.

Observe precautions printed on all reagent bottles. If the analyst uses a chemical which emits toxic fumes the work must be done in a fume hood. The fume hood must be inspected at least once each year to assure an adequate air displacement and to check for leaks in the duct work. Spills of such materials, such as mercury, must be cleaned up immediately using appropriate procedures.

3.5 Corrosive Materials

Most labs use concentrated acids and bases for a wide variety of purposes. These not only are corrosive to laboratory equipment and instrumentation, but can also damage clothing and cause severe burns. This is especially critical when these materials come in contact with the eyes.

Concentrations of acids and bases should always be specified on the label. When making up dilutions of acids always add the acid to the water or violent splashing or explosion will occur. Make such solutions cautiously and slowly, expecting the solution to get very hot. Quantities of these materials of one gallon or more are best stored in unbreakable containers. Put together a kit to handle spills of acids and bases and keep this in a handy location. Always wear eye protection, apron, and gloves when handling concentrated acids or bases.

3.6 Fire

Fires are usually caused by improper handling of chemicals or from overloaded or improper electrical conditions.

Follow proper storage procedures for all reagents. Dispose of chemicals in a safe manner. Observe shelf lives of any reagents which are so dated. Use common sense when using open flames. Know the service capacity of the electrical circuits in the lab to avoid creating an overloaded condition. Label all circuit breakers according to major equipment operated on each circuit.

3.7 General Lab Considerations

Cylinders of compressed gases are extremely dangerous and require special precautions for moving and storage. If the valve is knocked off accidentally the cylinder may be propelled with rocket force, damaging almost anything in its path. When moving cylinders the valve protection cap must be installed and the cylinder should be strapped to a trussed handcart. For storage and for use, the cylinders should be chained or strapped securely to prevent them from being knocked over.

Chemicals should be stored in an adequate storeroom. Heavy items should be stored as near as possible to the floor. All chemicals should be clearly labeled and dated. A discussion on proper labeling procedures follows this discussion. The storage room should be properly ventilated to prevent a possible buildup of vapors or heat.

Care should be taken to assure that incompatible materials are not stored together. The list on the pages following this discussion list some of the chemicals commonly used in wastewater analysis and indicate which materials may not be safely stored with them.

The lab must have at least one emergency eye wash and shower. These must be inspected and flushed at least once per month. The location of fire extinguishers, fire alarms, and telephones must be clearly visible. An emergency telephone number list should be developed and posted near the telephone. A first aid kit must be readily accessible in case of emergency.

Proper disposal procedures should be followed for any outdated or spent reagents. The local fire department may offer information or assistance in disposing of hazardous chemicals. Broken glass and glass containers should be disposed of in a container designated for only this type of waste.

3.8 Response to Emergencies:

In many types of emergencies quick response may mean the difference between having a close call or having a disaster. One of the best ways to assure a quick response to emergencies is to make sure that laboratory personnel are adequately trained in the use of safety equipment and in first aid procedures. Safety equipment training should

include the use of fire extinguishers, emergency shower and eyewash, respirators, and all other safety equipment which would be appropriate for the particular facility. First aid training should include basic first aid as well as a course in cardiopulmonary resuscitation.

In summary, the best way to prevent accidents from happening is to know the procedures and materials that must be used, to understand the hazards associated with them, and to use the proper safety precautions and equipment. The best way to prepare laboratory personnel to react to an emergency situation is by providing the necessary safety equipment and by providing training in their use.

3.9 Chemical Storage

THESE CHEMICALS:	SHOULD NOT BE STORED WITH:
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates.
Acetylene	Chlorine, bromine, copper, fluorine, silver.
Ammonium nitrate	Acids, powered metals, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials.
Carbon, activated	Calcium hypochlorite, all oxidizing agents.
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials.
Chromic acid	Acetic acid, naphthalene, camphor, glycerine, turpentine, alcohol, flammable liquids in general.
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals.
Copper	Acetylene, hydrogen peroxide.
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, the halogens.
Hydrocarbons	Fluorine, chlorine, bromine, chromic acid, sodium peroxide.
Hydrofluoric acid, anhydrous	Ammonia, aqueous or anhydrous.
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, flammable

	liquids, combustible materials.
Hydrogen sulfide	Fuming nitric acid, oxidizing gases.
Mercury	Acetylene, fulminic acid, ammonia, oxalic acid.
Nitric acid, concentrated	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases.
Oxalic acid	Silver, mercury.
Potassium permanganate	Glycerin, ethylene glycol, benzaldehyde, sulfuric acid.
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds.
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate, or similar compounds with light metals.

Personnel Safety Able to learn about the self-protection during working in the factory

3.10 Prepare the work place/ Housekeeping

Worker must be able to know about the Housekeeping & its advantages. Gather appropriate tools& equipment required to perform the housekeeping job. Knowledge of work place preparation to start the activity, Safe working environment & its advantages, Relation of organized workplace & performance. Ability to Identify & Select tools required, Arrange & place the Tools & equipment involved.

White Board & markers, Information sheet, Clean equipment, Sponge, Moping brush & cloth, Dust bins

3.11 Deal with work& health hazard.

Able to understand the work& health hazard. 4.2 Able to know about the possible injuries. 4.3 Able to know about the first aid. Knowledge of: -Health Hazard. -Possible work hazard. -First Aid provisions & emergency responses. - ERP Ability to: -Provide first aid to the fellow who is suffering. Response to emergency situation. 1. White Board & markers. 2.Information sheet 3. Clean equipment 4. Sponge 5. Moping brush & cloth. 6.Dust bins

4 First Aid

First aid is the first and immediate assistance given to any person suffering from either a minor or serious illness or injury, with care provided to preserve life, prevent the condition from worsening, or to promote recovery. It includes initial intervention in a serious condition prior to professional medical help being available, such as performing cardiopulmonary resuscitation (CPR) while waiting for an ambulance, as well as the complete treatment of minor conditions, such as applying a plaster to a cut.

Figure 1: Elements of First Aid Box

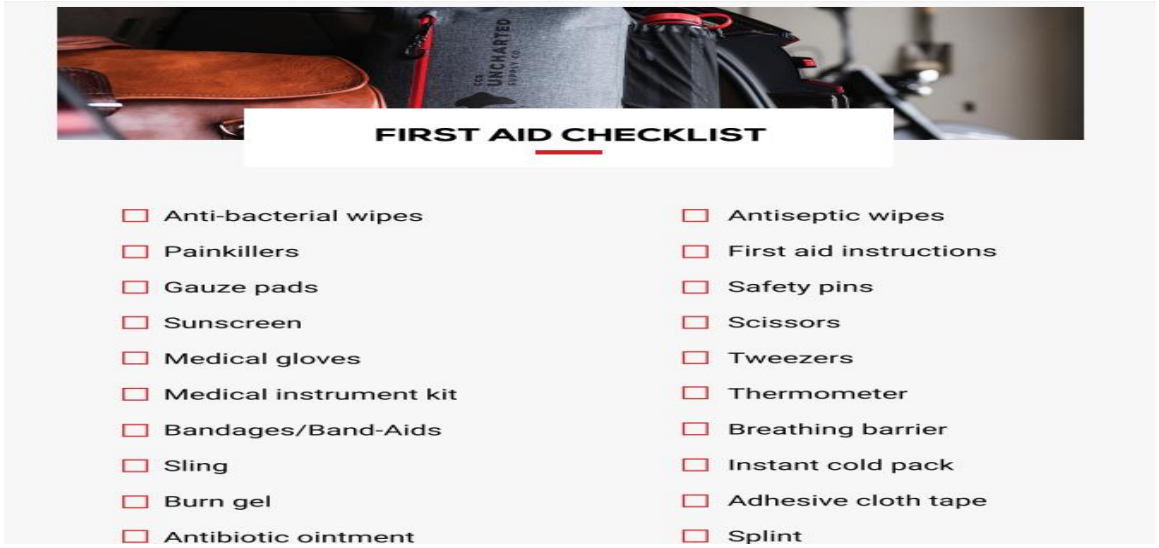

Figure 2: First aid Check list

Injuries are practically inevitable in emergency situations. There's a chance you get hurt by whatever's causing the emergency; for instance, you could get burned in a fire, or you could get struck by toppling debris during an earthquake. But injuries are also

sustained during the panic that ensues in an emergency. In the rush to get away from danger, you could sprain your ankle or suffer an open wound.

Here are 10 first aid “must-knows” that you can use to treat a broad array of injuries:

1. Remember the “Three P’s.”
2. Check the scene for danger before you provide help.
3. To treat cuts and scrapes, apply gentle pressure, disinfectant, and bandages.
4. To treat sprains, apply ice and compression at intervals and keep the limb elevated.
5. To treat heat exhaustion, use cool fluids, cool cloths, and shade.
6. To treat hypothermia; use warm fluids and warm covering.
7. To treat burns, determine the burn type and severity. Cover the wound with loose cloth to prevent infection.
8. Use an EpiPen to treat allergic reactions.
9. To treat fractures, keep the fractured area stable and immobilized, and apply a cold pack.
10. Perform CPR if an injured person stops breathing.

4.1 The “Three P’s”

The “Three P’s” are the primary goals of first aid. They are:

- Preserve life
- Prevent further injury
- Promote recovery

These goals might seem overly simple, but they're simple on purpose. When someone is injured, it's all-too-easy to panic and forget what you need to do to provide assistance. The Three P's remind you of the very basics: do what you can to save the person's life; do what you can to keep them from sustaining further injuries; do what you can to help them heal.

4.2 Check the Scene for Danger

Before you provide help to an injured person, it's important that you check the scene for danger. You don't want to get yourself injured, too. This isn't a cowardly precaution. The fact of the matter is this: if you get injured, you won't be able to help someone else who's injured. So before you rush to help someone, take a moment to analyze the area and spot anything that could injure you.

For example, there might be a terrible storm outdoors, and you spot someone outside who's injured and who can't make it to shelter. Before you go running outside to help them, look for hazards. Are strong winds hurling debris? Are there any trees or structures that look as if they're about to fall? Are there downed power lines? Is there floodwater?

Once you've assessed these dangers, you can better strategize how to reach and rescue the injured person.

4.3 Treating Cuts and Scrapes

Blood is a vital component of our bodies. When someone is bleeding, you want to prevent as much blood from leaving their body as possible. Try and find a clean cloth or bandage. Then:

- Apply gentle pressure for 20 to 30 minutes.
- Clean the wound by gently running clean water over it. Avoid using soap on an open wound.
- Apply antibiotic to the wound, like Neosporin.
- Cover the wound with a bandage.

If someone has a nosebleed, have the person lean forward. Press a cloth against the nostrils until the blood flow stops.

The body is usually very quick at patching up small cuts and scrapes. But deeper wounds may require medical attention. With deep wounds:

- Apply pressure.
- Don't apply ointments. Cover the area with loose cloth to prevent contaminants from infecting the wound.
- Seek medical attention as soon as possible.

4.4 Treating Sprains

Sprains are usually an unalarming injury, and most of the time they'll heal on their own. But there are steps you can take to ease the swelling. Swelling is caused by blood flow to an injured area. You can reduce swelling by applying ice. Ice restricts the blood vessels, which reduces blood flow.

- Keep the injured limb elevated.
- Apply ice to the injured area. Don't apply ice directly to the skin. Wrap it in a cloth or put ice in a plastic bag.
- Keep the injured area compressed. Put it in a brace or tightly wrap it. Don't wrap it so tight that it'll cut off circulation.
- Ice for a while. Then compress. Repeat at intervals.

Make sure the injured person avoids putting weight on the injured limb.

4.5 Treating Heat Exhaustion

Heat exhaustion occurs due to prolonged exposure to high temperatures, especially when the person is doing strenuous activities or hasn't had enough water. Symptoms of heat exhaustion include:

- Cool, moist skin
- Heavy sweating
- Dizziness

- Weak pulse
- Muscle cramps
- Nausea
- Headaches

To treat someone with heat exhaustion:

- Get the person to a shaded area that's out of the sun.
- If there are no shaded areas available, keep the person covered by any available materials that can block sunlight.
- Give the person water and keep them hydrated.
- Place a cool cloth on their forehead to lower their body temperature.

4.6 Treating Hypothermia

Hypothermia is caused by prolonged exposure to cold temperatures. It begins to occurs when your body temperature drops below 95 degrees Fahrenheit.

Symptoms of hypothermia include:

- Shivering
- Slurred speech or mumbling
- Week pulse
- Weak coordination
- Confusion
- Red, cold skin
- Loss of consciousness

To treat hypothermia:

- Be gentle with the afflicted person. Don't rub their body and don't move their body in too jarring of a way; this could trigger cardiac arrest.
- Move the person out of the cold, and remove any wet clothing.
- Cover the person with blankets and use heat packs. Don't apply heat directly to the skin because this could cause major skin damage.
- Give the person warm fluids.

If you set the person on the ground, be aware that the ground may also be a cold source. Place warm materials on the ground that the person is going to lay on.

4.7 Treating Burns

Before you apply treatment to burns, you need to identify the burn type and the severity of the burn. There are four kinds of burns:

- First-degree burn: Only the outer layers of skin are burnt. The skin is red and swollen, and looks similar to a sunburn.
- Second-degree burn: Some of the inner layer of skin is burnt. Look for blistering skin and swelling. This is usually a very painful type of burn.
- Third-degree burn: All of the inner layer of skin is burnt. The wound has a whitish or blackened color. Some third-degree burns are so deep, there might not be any pain because the nerve endings are destroyed.
- Fourth-degree burn: A burn that has penetrated all tissues up to the tendons and bones.

Additionally, there are two kinds of burn severities: a minor burn and a major burn.

- Minor burn: First-degree burns and mild second-degree burns.
- Major burn: Moderate second-degree burns to fourth-degree burns.

Minor burns don't usually need extensive treatment, but you could:

- Run cool water over the afflicted area (avoid icy or very cold water).
- Don't break any blisters.
- Apply moisturizer over the area, like aloe vera.
- Keep the burned person out of sunlight.
- Have the burned person take ibuprofen or acetaminophen for pain relief.

Major burns are very serious injuries that require medical assistance. To help someone who has suffered from a major burn:

- Do not apply ointments.
- Cover wound with loose materials to prevent contaminants from infecting it.

4.8 Allergic Reactions

Allergic reactions occur when your body is hypersensitive to a foreign substance. Bee stings, certain foods, or drug ingredients can cause allergic reactions. Anaphylaxis is a life-threatening allergic reaction that can be caused by all of those mention allergens.

The best way to treat an allergic reaction is to use an EpiPen. EpiPen, or “epinephrine autoinjector,” is a small and ergonomic needle that’s used to inject epinephrine (adrenaline) into someone suffering greatly from an allergic reaction. The epinephrine usually subdues the effects of the allergic reaction.

If someone is suffering from an allergic reaction:

- Keep the person calm. Ask if they use an EpiPen and have one with them.
- Have the person lie on their back. Keep their feet elevated 12 inches.
- Make sure the person’s clothing is loose so they’re able to breathe.
- Avoid giving them food, drink, or medicine.
- If appropriate, use an EpiPen. Learn how to inject an EpiPen in someone having a reaction.
- Wait 5-15 minutes after using an EpiPen. If the allergic reaction isn’t subdued, a second dose may be required.

4.9 Treating Fractures

Sometimes it's very easy to tell if someone has suffered a fractured bone. But sometimes it's not. If you suspect someone of having a fracture:

- Don't try to straighten a fractured limb.
- Use a splint or padding to stabilize the area and keep it from moving.
- Apply a cold pack to the area. Don't apply it directly to the skin. Wrap it in a cloth or put it in a plastic bag.
- Keep the area elevated, if possible.
- Give the person an anti-inflammatory drug, like ibuprofen.

4.10 Performing CPR

CPR stands for cardiopulmonary resuscitation. CPR is used to restore breathing and blood circulation to an unresponsive person. CPR is an incredibly important procedure that can save lives. But learning CPR is an intensive procedure that requires some training, which is usually in the form of a day-long class. The American Red Cross offers CPR certification classes across the nation. Go to Redcross.org for more information.

4.11 Prepare Yourself with the Right Gear

The methods listed above are not very difficult to do and they don't require medical training—but they can save someone's life or prevent an injured person from sustaining serious injuries or infections. Make sure that your stash of survival gear includes a first aid kit, and be sure to refill your first aid kit every year as its supplies dwindle or expire.

The essential first aid kit should include:

- Anti-bacterial wipes
- Painkillers
- Gauze pads
- Sunscreen
- Medical gloves
- Medical instrument kit
- Sling
- Burn gel
- Antibiotic ointment
- Antiseptic wipes
- First aid instructions
- Tourniquet

Download our first aid checklist and make sure you’re ready for anything you may encounter.

5 Personal Hygiene

The human body can provide places for disease-causing germs and parasites to grow and multiply. These places include the skin and in and around the openings to the body. It is less likely that germs and parasites will get inside the body if people have good personal hygiene habits.

5.1 Good personal hygiene

Good personal hygiene habits include:

- washing the body often. If possible, everybody should have a shower or a bath every day. However, there may be times when this is not possible, for example, when people are out camping or there is a shortage of water
- If this happens, a swim or a wash all over the body with a wet sponge or cloth will do
- cleaning the teeth at least once a day. Brushing the teeth after each meal is the best way of making sure that gum disease and tooth decay are avoided. It is very important to clean teeth after breakfast and immediately before going to bed
- washing the hair with soap or shampoo at least once a week
- washing hands with soap after going to the toilet
- washing hands with soap before preparing and/or eating food. During normal daily activities, such as working and playing, disease causing germs may get onto the hands and under the nails. If the germs are not washed off before preparing food or eating, they may get onto the food
- changing into clean clothes. Dirty clothes should be washed with laundry soap before wearing them again
- hanging clothes in the sun to dry. The sun's rays will kill some disease-causing germs and parasites
- turning away from other people and covering the nose and mouth with a tissue or the hand when coughing or sneezing. If this is not done, droplets of liquid containing germs from the nose and mouth will be spread in the air and other people can breathe them in, or the droplets can get onto food

Figure 3: Washing the body helps keep it free of disease-causing germs

Figure 4: Cleaning teeth helps keep gums and teeth healthy

Figure 5: Washing hands after going to the toilet helps stop the spread of germs

Figure 6: Washing hands before preparing food helps keep germs out of our bodies

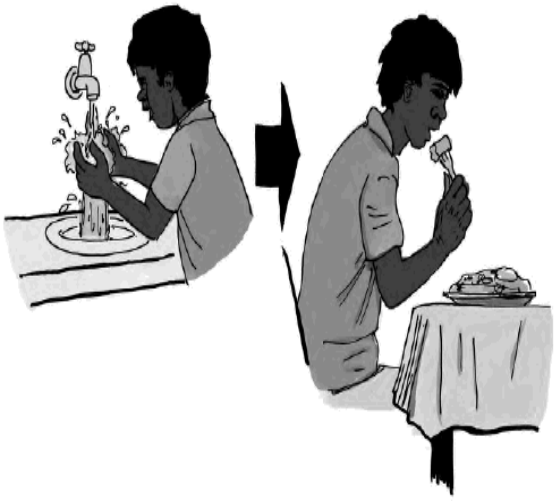

Figure 7: Washing hands before eating food helps stop germs getting into our bodies

Figure 8: Washing clothes helps keep them free of disease-causing germs

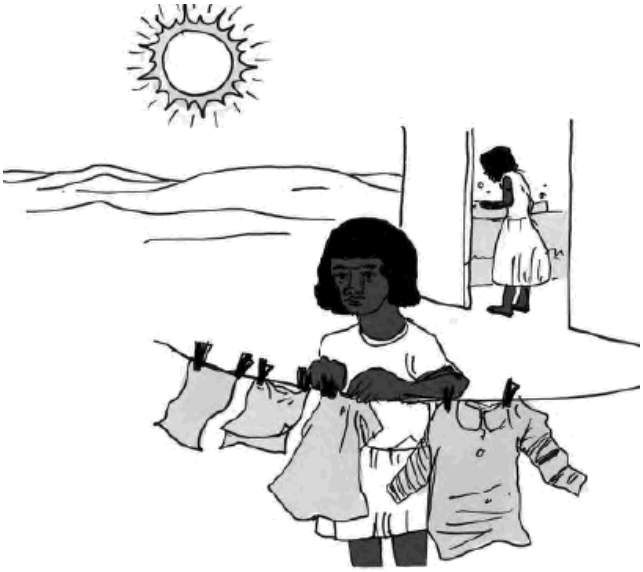

Figure 9: Hanging clothes in the sun helps to kill some disease-causing germs and parasites

Figure 10: Covering the nose and mouth when sneezing helps stop the spread of germs

5.2 Overcrowding

When there are too many people in any house, the likelihood of them getting disease is greater than if the house is not overcrowded. This is because people in an overcrowded house will be much closer to each other and it is therefore easier for any germs to spread from one to another. For example:

- sneezing and coughing in crowded rooms makes it easier to spread cold and flu germs
- sharing towels can spread trachoma germs and other germs which cause eye infections (runny or sore eyes)
- several children sleeping in the same bed makes it easier to spread a scabies infection

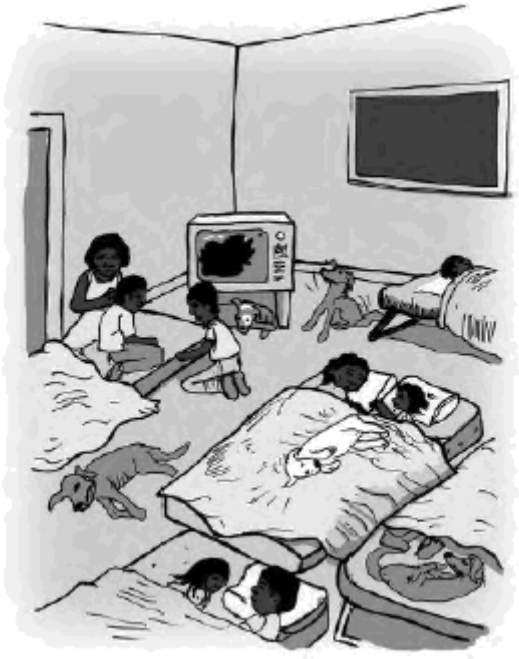

Figure 11: Overcrowding helps spread germs and parasites such as scabies.

Each house is designed to allow a particular number of people to live there comfortably. This number will depend upon the number and size of the rooms, especially bedrooms, and the size of other facilities such as the sewage system and washing and cooking areas.

If the number of people living in the house is greater than the number it was designed for, these facilities will not be able to cope properly. For example, large numbers of people using the toilet may mean that the septic tank will not be big enough to take and treat the additional load of sewage.

For good health and comfort, the number of people who should live in a house depends upon the factors outlined below.

5.2.1 The number and size of bedrooms

While most people who live permanently in a house will have a bedroom to themselves or share one with one or two other people, other rooms are often used as bedrooms. The number of people who should sleep in a room will depend upon the amount of air

which is available to each person. The law requires that each adult person has at least 13 cubic metres of air and each child has at least 10 cubic metres of air in a sleeping area.

5.2.2 The type and size of the sewage system

Usually, a household septic tank system with 2 round tanks caters for a maximum of ten people.

5.2.3 The size and availability of other facilities

The facilities within the house may not be able to handle all of the demands placed on them by the occupants. For example, the hot water system may not be able to produce enough hot water, or the amount of food to be chilled is too great for the refrigerator to hold.

In Indigenous communities, overcrowding in houses occurs for a number of reasons, such as:

- there not being enough houses for the number of people who live in the community
- families not being able to afford to pay rent on a house of their own and needing to live with relatives to share the cost
- people visiting relatives and staying for a long time
- visitors coming to stay so that they can attend special events such as funerals