ENVIRONMENTAL HEALTH

OBJECTIVES

1. Explain the importance of environment to community health
2. Discuss water and sanitation in relation to health
3. Outline appropriate methods of preserving food
4. Discuss the effects of housing on health
5. Mobilize the community in control of vectors and pests

definations

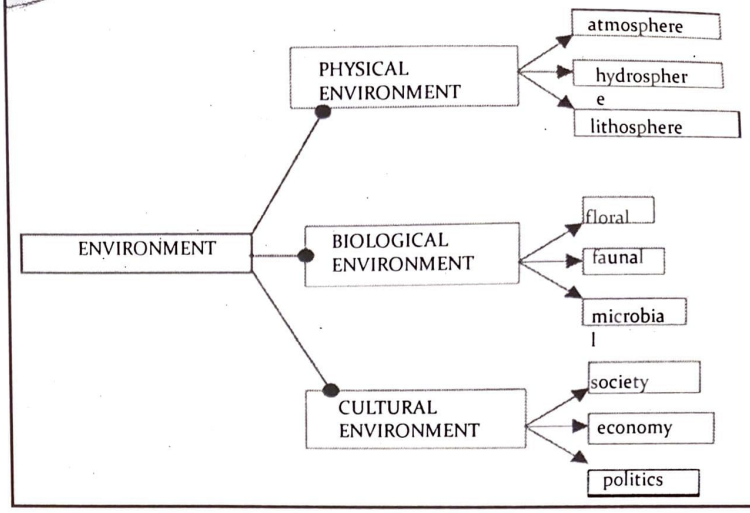
- **Environment-:**
  - The sum of all living and non-living things that surround an organism, or group of organisms
  - **Boring: 'A person's environment consists of the sum total of the stimulation** which he receives from his conception until his death.'
  - **Douglas and Holland: 'The term environment is used to describe, in the** aggregate, all the external forces, influences and conditions, which affect the life, nature, behavior and the growth, development and maturity of living organisms.'

- **health**
  - The state of being free from illness or injury:
  - A person's mental or physical condition.
  - (WHO) defined health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.
- **Environmental health-:**is the branch of public health that is concerned with all aspects of the natural and built environment that may affect human health.

EH def cont'

- Those aspects of the human health and disease that are determined by factors in the environment. It also refers to the theory and practice of assessing and controlling factors in the environment that can potentially affect health(WHO)

ENVIRONMENT



Types of environment

Physical environment:-

- It includes the geographical and man-made elements that surrounds an individual.
- Geographical elements include:-
  - Land
  - Soil type
  - Climate
  - Altitude
  - Rivers
  - topography

- These elements have direct influence on health of the people inhabiting a place.
- ***Land*** is essential for human settlement
  - When it is scarce, overcrowding occurs which increases the likelihood of spread of airborne diseases
  - When the land is fertile, there is adequate food to nourish the population.
  - When the land is infertile, productivity is reduced and malnutrition diseases sets in

- **Climate** is the weather conditions prevailing in an area in general or over a long period.
  - Climate dictates what kind of food can be grown at different places.
  - Cold climates encourage respiratory diseases
  - Diseases like malaria are associated with hot climates and so are snake bites.
  - Some disease outbreaks follows certain weather patterns eg cholera, typhoid, and malaria in rainy seasons, trachoma in dry seasons
  - Different climates are inhabited by different animals which influence spread of diseases to man

- **Altitude** is how high a place is from the sea level. The higher the place from the sea level, the colder it is.
- Temperatures influence crop cultivation, economic activities and biotic constitution in a place.
- Humidity is also associated with altitude since the lower the place, the closer to the sea and the higher the humidity. Humudity influences respiratory diseases.

- Pollution is very important in health. Various factors such as industrial emissions and discharges, use of pesticides, plastic bags etc pollute air, water and soil. These poses direct health problems to people
- Example
  - Lead, mercury poisoning
  - DDT poisoning
  - Asbestos poisoning

- The manmade elements of environment includes:
- Roads
- Houses
- Dams
- Industries
- Chemicals etc

Biological environment

- Encompasses all living things that surrounds someone.
- These includes
  - The plants
  - People
  - Animals
  - Microorganism
- The plants provides vegetation cover and thus, prevent soil erosion, act as wind breakers, provide wood and timbers. Some are used as medicine

- People serve as reservoirs for infections to other humans. Human activities such as quarrying produces deep pits that hold water serving as breeding sites for vectors
- Domestic animals provide people with proteins, milk, and hides and skins. Cats and dogs are kept as pets but they can also transmit diseases to man. Other hazards associated with animals include:

- Some acts as vectors eg mosquitoes, house flies
- snakebites
- insect bites
- Microorganisms eg fungi, bacteria, viruses and rickettsia cause diseases in man. Some other microorganisms serve as source of antibiotics used in treatment eg penicillin

Socio-cultural environment

- This refers to the social and cultural practices, beliefs and traditions within a particular society.
- refers to the physical or social setting in which people live or in which something happens or develops. It may be the culture that the individual was educated or lives in, or the people and institutions with whom they interact

- Factors related to socio-cultural environment that can affect health include:-
- Culture
  - Customs
  - Beliefs
  - Religion
  - Values
- Social
  - Family - kinship - housing
  - Leadership - power -structure

- Some of the issues affected by socio-cultural environment includes:
  - Food and cooking habits- taboos
  - Wife inheritance
  - Polygamy practices
  - Tattoos for beautification-HIV/AIDS, hepatitis B
  - Female genital mutilation
  - Discouraging breastfeeding

Economic and political environment

- This includes work, money and government.
- Economies can be classified as rural and urban economies.
- Depending on the work that people does for development and earn a living, effects are felt in health sector.
- Good source of income means better standards of living and thus, improved health status.

- Some economic activities like flood irrigation schemes provides the community with money and food. At the same time, people are predisposed to water borne diseases for example schistosomiasis.
- People of low economic status may revert to drinking to reduce stress predisposing themselves to alcohol-related diseases.

- Leadership and government is involved in formulation of policies which govern training health care personal, disease prevention protocols, treatment guidelines, etc. the soundness and effectiveness of these policies influences health of the communities greatly.

RELATIONSHIP BETWEEN POPULATION AND ENVIRONMENT

✓We consume resources such as land,food,water,soil.

✓Overconsumption depletes supplies of non-renewable resources, such as fossils and renewable resources such as fisheries and forests if we use them up faster than they can replenish themselves

✓We emit wastes as a product of our consumption activities, including air and water pollutants, toxic materials, greenhouse gases and excess nutrients. Some wastes, such as untreated sewage and many pollutants, threaten human health

PRINCIPLES OF ENVIRONMENTAL HEALTH

✓Nurses have been leaders in advocating for and implementing environmental principles into their professional roles and practices, not only to help eliminate the problem, but to use precaution when science is not yet able to fully establish the cause and effect relationship

1) The Precautionary Principle,

✓ which ANA adopted in 2003, implies that there is an ethical imperative in preventing disease rather than just treating disease, thus transferring the burden of proof to those creating the risk.

✓The principle advocates taking the life cycle of chemicals, products, or technologies into consideration and acting accordingly to prevent exposures. It is wise to be proactive rather than sit back and prepare to treat the disease resulting from environmental insult

2)Everything is connected to everything else.

✓The principle of connectiveness is the essence of tracking exposure

✓Everything has to go somewhere

✓Once the waste products are generated they must be disposed off somewhere in one way or the other.i.e;-incineration(burning), water discharge &burying

Factors necessary for the chain of connection to occur

✓Source of harm i.e. chemicals

✓An environmental media for transport e.g. air, water or soil

✓A root of exposure(inhalation, ingestion and dermal absorption)

✓A receptor population (within the exposure pathway)

3)The solution to pollution is dilution

✓the environment has the capacity to assimilate the end product of human civilization.

✓Nature takes care of everything in the environment

4)Todays solution may be tomorrow's problem

✓Example ,charcoal burning for fuel causes desertification

THE ROLE OF A COMMUNITY HEALTH NURSE IN ENVIRONMENTAL HEALTH

According to Florence Nightingale, 1860:

"In watching diseases, both in private homes and in public hospitals, the thing which strikes the experienced observer most forcibly is this, that the symptoms or the sufferings generally considered to be inevitable and incident to the disease are very often not symptoms of the disease at all, but of something quite different—of the want of fresh air, or of light, or of warmth, or of quiet, or of cleanliness, or of punctuality and care in the administration of diet, of each or of all of these".

✓Environmental determinants of health and disease are pervasive and integral to the assessment, diagnosis, intervention, planning, and evaluation components of nursing practice

✓However, environmental factors that affect health are commonly overlooked in routine patient assessments. When environmental health concerns are missed, an opportunity for prevention is lost, and public health is less well served.

- Although not every illness has an environmental etiology, nearly everyone will have a health problem related to an environmental hazard for which evaluation or advice is appropriate in terms of good nursing practice

✓It is important in nursing practice to identify not only the hazards that contribute to a current diagnosis (e.g., exposure to lead-contaminated dust resulting in elevated blood lead levels, and outdoor ozone or indoor allergens exacerbating childhood asthma),

✓but also those that have not yet caused illness but are amenable to intervention (e.g., friable asbestos, radon, formaldehyde gases from building materials, and carbon monoxide and nitrogen oxides from poorly ventilated furnaces).

✓By taking a proactive approach, nurses can initiate preventive actions to abate hazards before they manifest as disease. Thus, consideration of environmental health concepts as a core nursing function will vastly strengthen nursing's contribution to disease prevention.

WATER AND SANITATION

- Water is very important commodity without which terrestrial life would be impossible.
- Water helps human beings in many ways and influences the quality of health depending on it quality and availability.

Purpose/uses of water

a) Domestic uses- drinking, cooking, washing utensils, flushing latrines, personal cleanliness, etc
b) Industrial use- production of electricity, paper industries, etc
c) Agricultural use- irrigation, watering animals.
d) For recreational activities like swimming
e) Sustaining of aquatic life

Water requirement

- The consumption of water depends on climatic conditions, availability, standards of living and the habit of the people.
- Generally, every individual requires about 150-200 liters of water per day (35-40 gallons)
- In hospitals, people require 40-50 gallons per head per day.
- The water that is safe for human use is termed as acceptable or portable water.

- Characteristics of safe/portable water:
  - Free from pathogens
  - Free from harmful chemical substances.
  - Pleasant to taste
  - Useable for domestic use.

Sources of water

- **Rain water-**
- Rain is the major source of water
- Rain water is considered the purest water, but it quality is dependent on atmospheric pollution, how water is collected and storage.
- Characteristics
  - It is soft
  - It is clear, bright and sparkling
  - It is purest water in nature

- **Surface water**
- This source includes:-
  - Rivers
  - Lakes -pods
  - Springs -shallow wells
  - Streams
  - dams

- A river is a mass of flowing water. River water carries a lot of impurities and need purification to make it safe for drinking.
- Sources of impurities in river water includes:
  - Impurities from surface washing
  - Sewage water
  - Industrial and trade waste
  - Drainage from agriculture

- A spring is a natural issue of underground water.
- Surface water is all the water found above the impermeable rock, and usually collects there after the rain.
- If the well is dug to access the ground water above the impermeable rock, it is called a shallow well.

- **Underground water-**
- This is water that gets trapped between two impermeable rocks, one above and one below.
- If this water finds a way out through a fissure, then it is called a deep spring
- This water can also be accessed through a deep well or a borehole

- Characteristics of ground water
  - Likely to be free from pathogenic agents
  - Supply is certain even during the dry seasons
  - It is hard because of presence of calcium and magnesium ions
  - It is salty
  - Usually require no treatment
  - Requires pumping to the ground

- **Sea water-**
- This water is salty and requires expensive purification to make it safe for drinking.
- In Kenya we have salty lakes whose water requires same purification as sea water eg lake magadi, lake Bogoria, lake Nakuru, etc

Water pollution

- Def: this is addition of a substance that changes the natural qualities of water.
  - Sources of water pollution
  - Sewage which contains decomposable and infective organisms
  - Industrial waste which contains heavy metals, organic compounds etc
  - Agricultural pollutants like fertilizers, pestcides etc
  - Physical pollutants like heat, radiation, etc

Hazards of water pollution

Can be classified as:-

- Biological hazards
- Chemical hazards

- Biological hazards include diseases related to water. Infectious diseases related to water pollution are classified into:-
- Water-borne diseases are infections that predominantly are transmitted through contact with or consumption of infected water. In other words, the infecting organism remains alive in drinking water.

- Examples of water-borne diseases
- Bacterial-
  - Cholera - typhoid - paratyphoid
  - Gastroenteritis - dysentery
- Viral
  - Polio - hepatitis A, E - SARS
- Protozoan
  - Amoebiasis - cryptosporidiosis – giardiasosis
- Parasitic
  - ,Hymenolepiasis (Dwarf Tapeworm Infection), Enterobiasis

- Water-washed diseases- are diseases that results due to lack of or inadequate water. Examples-
- Scabies - trachoma - typhus
- Water-based diseases are infections that results due to presence of a host in water
- Examples-: Schistosomiasis, Dracunculiasis (Guinea Wormdisease)

- Water breeding or proximity diseases are infections spread by vectors that breed in water. Example malaria, diarrhea of which causal organisms are spread by flies.

Chemical hazards-

- These are chemical elements in water that poses risk to human health. Examples:- Arsenic, Barium, Lead, Manganese, Tetrachloroethylene (Dry Cleaning Solvent), Selenium, Chromium, Beryllium and Nickel.
- These compounds can cause organ damage, cancer, teeth decay and birth defects

Hardness of water

- Hardness of water is determined by the concentration of multivalent cations in the water. Multivalent cations are positively charged metal complexes with a charge greater than 1+. Usually, the cations have the charge of 2+. Common cations found in hard water include Ca^{2+} and Mg^{2+}

- Hardness in water can be classified as:-
  - **Temporary hardness**
  - **Permanent hardness**
- Temporary hardness is a type of water hardness caused by the presence of dissolved carbonate minerals (calcium carbonate and magnesium carbonate). Temporary hardness can be removed by boiling or adding lime in water

- **Permanent hardness** is hardness (mineral content) that cannot be removed by boiling. When this is the case, it is usually caused by the presence of calcium and magnesium sulphates and/or chlorides in the water, which become more soluble as the temperature increases.

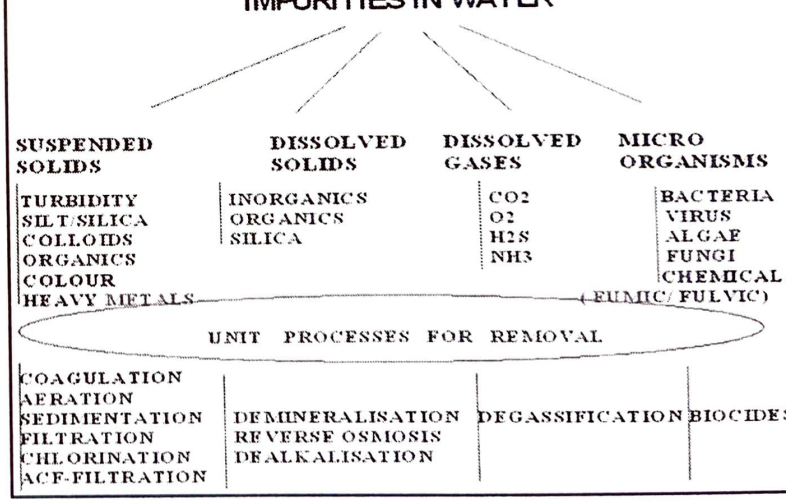
Disadvantages of hard water

- Consumes more soap and detergent
- Leads to scaling of boilers
- It prolongs cooking
- Reduces the durability of garments washed in it.
- Not suitable for many industrial processes.

Removal of hardness in water

- Temporary hardness
  - Boiling
  - Addition of lime
- Addition of sodium bicarbonate or washing soda removes both temporary and permanent hardness
- Permanent hardness
  - Sodium bicarbonate
  - Base exchange method or permutit method (a mixture of sodium, aluminum and silica)

WATER PURIFICATION



MUNICIPAL OR UTILITY WATER TREATMENT

- Most municipal water found in a city or community today has been treated extensively. Specific water treatment methods and steps taken by municipalities to meet local, state, national, or international standards vary but are categorized below
- **Screen prefiltration**
  A coarse screen, usually 50 to 100 mesh (305 to 140 microns), at the intake point of a surface water supply, removes large particulate matter to protect downstream equipment from clogging, fouling, or being damaged

- **Clarification/ flocculation**
  Clarification is generally a multi-step process to reduce turbidity and suspended matter. Steps include the addition of chemical coagulants or pH-adjustment chemicals that react to form floc. The floc settles by gravity in settling tanks or is removed as the water percolates through a gravity filter. The clarification process effectively removes particles larger than 25 microns. The clarification process is not 100% efficient; therefore, water treated through clarification may still contain some suspended materials.

- Coagulants / flocculating agents that may be used include:
- Iron(III) hydroxide. This is formed by adding a solution of an iron (III) compound such as iron(III) chloride to pre-treated water with a pH of 7 or greater.
- Aluminium hydroxide is also widely used as the flocculating precipitate .
- PolyDADMAC is an artificially produced polymer and is one of a class of synthetic polymers that are now widely used.

- **Filtration**
- After separating most floc, the water is filtered as the final step to remove remaining suspended particles and unsettled floc.
- The most common type of filter is a rapid sand filter. Water moves vertically through sand which often has a layer of activated carbon or anthracite coal above the sand. The top layer removes organic compounds, which contribute to taste and odour. The space between sand particles is larger than the smallest suspended particles, so simple filtration is not enough. Most particles pass through surface layers but are trapped in pore spaces or adhere to sand particles.

- **Disinfection**
- Disinfection is accomplished both by filtering out harmful micro-organisms and also by adding disinfectant chemicals. Water is disinfected to kill any pathogens which pass through the filters and to provide a residual dose of disinfectant to kill or inactivate potentially harmful micro-organisms. Following the introduction of any chemical disinfecting agent, the water is usually held in temporary storage – often called a contact tank or clear well to allow the disinfecting action to complete.

- Methods used include:
  - Chlorine disinfection
  - Chlorine dioxide disinfection
  - Chloramine disinfection
  - Ozone disinfection
  - Ultraviolet disinfection
  - Solar water disinfection
  - Hydrogen peroxide disinfection

Purification of water on small scale

1) Boiling

- Involves heating water to boiling point for 5-10 minutes to kill spores of bacteria, cysts, expel carbon dioxide and remove hardness.
- It is the most common method of water purification in rural areas.
- Water should preferably be heated in the same container in which it will be stored to avoid contamination.

2) **Straining**

- Pouring turbid (cloudy) water through a piece of fine, clean cotton cloth will often remove a certain amount of the suspended solids contained in the water.
- Purpose-made monofilament filter cloths can be used in areas where guineaworm disease (dracunculiasis) is endemic. Such cloths are effective in straining out the copepods in the water.

3) Three pot system

- This method involves use of three pots in series to treat water for drinking. Water is poured in pot 1, allowed to stand over nite, the following day it is carefully poured in pot 2. pot 1 is washed and water from the source is poured there. When water in pot three is used, it is washed and water in pot 2 poured there.

- Chlorination- addition of chlorine in water to kill pathogens.

WASTE MANAGEMENT

- **Waste management** is the collection, transport, processing or disposal, managing and monitoring of waste materials. The term usually relates to materials produced by human activity.

Types of waste

- <u>Liquid waste:</u>
- This includes the human excreta and urine. This wast harbors pathogen and is offensive to both site and smell. Fecal matter transmit various diseases to man, and these diseases have a fecal oral mode of transmission. Examples: cholera, polio, typhoid, dysentry, intestinal worms etc.
- urine transmits infections such as schistomiasis

- **Solid waste:**
- Also known as refuse.
- It is any discarded materials, the remains or residue of human activity that are no longer required.
- Problems related to improper refuse disposal:
  - Production of offensive smell
  - It attracts insects, pests and vectors eg flies, rats
  - Causes pollution of water, air and soil.
  - Can cause accidents eg fires, cuts and falls

Sources of solid waste

1. Domestic waste- consist of all garbage that emerge from the house. Eg potato peels, banana peelings, waste papers, worn out clothings, broken utensils, etc
2. Street waste- consist of papers, food and commercial refuse from markets, scrap metals etc
3. Industrial waste- this varies according to the type of the industry. Includes chemical waste which is hazardous to health
4. Hospital waste: all the waste generated in the course of provision of health care in medical institutions eg sharps, body tissues, food remains, etc
5. agricultural waste- waste from gardens.

Management of solid waste

- Involves the following steps
  - Storage management
  - Collection and transportation
  - Disposal
- **storage management**
- Usually starts at the source of the waste ie the household or commercial facility
- The storage should be convenient and of low risk

- Household storage facilities includes:
  - Non standard storage devices such as plastic papers, boxes baskets etc
  - Disadvantages
    - Encourage breeding of flies
    - Produce bad smell
    - Are not hygenic
    - Attracts rats and other rodents

- Standardized devices that include galvanized tins, plastic dustbins with lids, plastic papers with ties etc
- These are better because
  - They are reusable
  - Are more hygienic
- Commercial storage facilities- these are either portable or stationary. They include galvanized steel bins, trailers, etc

- Collection and transportation
- Involves picking of garbage from the point of storage and moving it the point of disposal.
- There are four main collecting systems:
  - Door to door collection
  - Kerbside collection
  - Local/block collection
  - Communal collection depots

- **Door to door collection** is where the waste collection vehicles calls at the house and owners give their refuse for disposal.
- **Kerbside collection**- each household has a galvanized bin put at the entrance where garbage is picked by collection vehicle
- **Local/ block collection**- the collection vehicle comes at a set time, in a set place and day. The household carry the refuse in their bin and pour the refuse in the collection vehicle.
- **Communal collection depot**: refuse is put in an enclosure. The people in collection vehicles empties and clean them

Methods of solid waste disposal

1. **Incineration**

- Incineration is a disposal method in which solid organic and iorganic wastes are subjected to combustion so as to convert them into residue and gaseous products. This method is useful for disposal of residue of both solid waste management and solid residue from waste water management.
- Incineration and other high temperature waste treatment systems are sometimes described as "thermal treatment". Incinerators convert waste materials into heat, gas, steam and ash.

2) Landfill/ controlled tipping

- Disposing of waste in a landfill involves burying the waste. Landfills are often established in abandoned or unused quarries, mining voids or borrow pits. A properly designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials.
- The refuse is deposited, spread and when the area is full, is buried using earth

4) Composting-

- This is the process where by under suitable environmental conditions, organic refuse is broken down into humus.
- Only materials that can be broken down by microorganisms should be decomposed
- It is a cheap and convenient method recommended in rural areas
- The method require frequent turning after 30 days. The refuse is ready to be used as manure after 60 days.

5) Open burning

- Is a frequently used method but not very effective.
- The method leaves bottles, tins, and other waste littering the surroundings
- The smoke and odor contributes to air pollution.
- Also there is a risk of fire involved.

6) Recycling

- This is a method of reusing waste products eg bottles, paper, plastics etc

Liquid waste

- Liquid waste consist of:
  - Sanitary waste
  - Industrial waste water
- Sanitary waste water includes sullage which is water from bathrooms, kitchen and laundry waste
- Industrial waste water is the water that comes as by product of industrial processes such as meat processing, creameries, breweries, paper mills etc
- Industrial waste is connected into sewage system. However, chemicals in some industrial waste can interfere with biodigestion in sewage treatment and therefore, should be given some special treatment before being discharged into local authorities sewage system

Treatment of liquid waste

- Treatment is necessary in order to kill the disease causing organisms and to convert water into a re-useable resource.
- The principle involved is holding sewer in an open or closed space for a few days to allow liquid and solid matter to separate and biological processes to turn them into safer more useable forms
- Definitions:
- Sewer- Waste water and excrement conveyed in sewers.
- *Sewage*- An underground conduit for carrying off drainage water and waste matter
- *Sewage system*- A drainage *system* for carrying surface water and *sewer* for disposal.

Small scale system

- Involves the use of septic tanks
- Is the suitable method to use at home or in small institutions
- The sewage drains into an underground concrete tank where the sewer settles and anaerobic bacteria digests(**anaerobic *digestion)*** it producing a solid sludge and a fairly clear effluent. This if the fluid that flows from the outlet pipe from time to time. It is allowed into the soak pit where they are acted upon by the aerobic bacteria resulting in a safer end product. This is called ***aerobic oxidation***

Water-borne/water carriage/large scale system

- When buildings are connected to a sewage system, they are said to have water-borne or water carriage sanitary system.
- The sewage system carries the sewer to sewage work where the treatment is done.
- Steps in sewage treatment:

SEWAGE
↓
SCREEN
↓
GRIT CHAMBER
↓
PRIMARY SEDIMENTATION TANK →SLUDGE DIGESTER→SLUDGE DRYING BEDS
↓
BIOLOGICAL TREATMENT
↓
FINAL SEDIMENTATION TANK →SLUDGE DIGESTER→SLUDGE DRYING BEDS
↓←CHLORINE
EFFLUENT DISPOSAL

- **Screening**
- The influent sewage water passes through a bar screen to remove all large objects like cans, rags, sticks, plastic packets etc. carried in the sewage stream. This is necessary to prevent blocking in the treatment plant
- **Grit removal**
- Pre-treatment may include a sand or grit channel or chamber, where the velocity of the incoming wastewater is adjusted to allow the settlement of sand, grit, stones, and broken glass.

- **Primary treatment**
- In the primary sedimentation stage, sewage flows through large tanks, commonly called "pre-settling basins", "primary sedimentation tanks" or "primary clarifiers. The tanks are used to settle sludge while grease and oils rise to the surface and are skimmed off.
- trickling filter/aeration chamber
- The effluent from primary sedimentation tank still contains considerable organic material and microorganisms.

- trickling filter beds are used where the settled sewage liquor is spread onto the surface of a bed made up of coke (carbonized coal), limestone chips or specially fabricated plastic media. Here, aerobic oxidization takes place

- **Secondary treatment**
- **It** is designed to substantially degrade the biological content of the sewage . The majority of municipal plants treat the settled sewage liquor using aerobic biological processes. To be effective, the biota require both oxygen and food to live. The bacteria and protozoa consume biodegradable soluble organic contaminants (e.g. sugars, fats, organic short-chain carbon molecules, etc.) and bind much of the less soluble fractions into floc. Secondary treatment systems are classified as *fixed-film* or *suspended-growth* systems.

- **Digestion**
- The sludge is pumped into sludge digestion tank where it undergoes anaerobic auto digestion in which complex compounds are broken down into water, carbon dioxide, methane and ammonia. This process can take 3-4 weeks to be completed.

Other methods

a) **Pit latrine**

- Consist of a rectangular or circular hole not less than 15 feet deep. It should have a floor slab with an opening and a super structure, ie, the walls and the roof. The floor should support the human weight and withstand frequent washing.
- Characteristics
  - Should be 2-3 meters from underground water sources
  - Should be 10-20 meters from the human house
  - Should be on the leeward side of the house
  - Should be adequately ventilated and well-lit
  - Should have a fly-proof cover
  - The door should open to the outside
  - The soil should be permeable to allow the liquid part of the excreta to sip through
  - Should be kept clean at all the time

b) **Ventilated improved pit latrine (VIP)**

- The Ventilated Improved Pit Latrine is an improvement on standard pit latrines that eliminates flies and odor.
- It has a vent pipe behind it to reduce odor and wire mesh to keep off the flies from entering the pipe.
- Advantages of vip
  - Has no bad odor
  - No disturbance and breeding of flies
  - Distance btwn the toilet and the house can be reduced because there are no flies
  - The slab can be reused once the toilet is filled up

c) **Bucket latrine**

- Used in areas where soil is very soft or rocky to dig a pit.
- Buckets are emptied in pit latrines or trenches mostly at night
- Common in wajir area in kenya.
- The excreta is referred to as night soil

d) **Chemical closet toilet**

- Used in planes, trains and ships
- After the excreta is deposited into the chemical closet, chemicals are used together with deodorizers or perfumes to liquefy and sterilize the waste and on arrival the content is emptied into the sewage system

ENVIRONMENTAL POLUTION

- ✓ Pollution is the introduction of contaminants into the natural environment that cause adverse changes
- ✓ Polluatnts,the components of pollution,can be either foreign subsatances,energies or naturally occurring contaminats