ENVIRONMENT AND HEALTH

- Environment:

  Whatever surrounds the individual constitutes his environment

External Environment: Includes Water, air, Soil, Noise,

Internal Environment: Includes internal system of body and their function.

Body maintains an equilibrium between internal and external environment,

But some times that state of equilibrium gets disturbed due to which the disease cause.

- Healthy environment will prevent the disease so there is need of environment sanitation.
- If environmental factors controlled it will bring a good health.

so steps needed to taken like,

water purification, waste deposition, cleanliness in living. Which will prevent the disease occurrence due to environmental factors

Water

Water is essential for all living things.

The water intended for human consumption should be not only “safe” but also “wholesome” the safe water is that which does not harm consumer.

Water must conform 2 criteria

a) The quality of water must be acceptable

b)The quantity must be sufficient to meet present and future requirements

- Safe Water: Safe water is a water which is free from disease causing microorganism, harmful chemicals, industrial wastes.

  and should be free from any bad taste, smell, odour.
- Contaminated Water: water which contains disease causing agents or bad taste, smell or odour

sources of water

There are three main sources of water :

- Rain.
- Surface water,
- Ground water

Rain

- Rain is the prime source of all water. Rain water is the purest water in nature, soft and containing traces of dissolved solids.

  Rain water tends to become impure as it passes through atmosphere.

There are very few places which depend upon the rain as source of water supply.

- **Surface Water** :-The surface water originates from rain water. The sources of surface water are:

reservoirs :-

- These are large artificial lakes constructed with earth work, in which large quantity of water is stored.
- They are considered as good source of water,
- **It** gives usually a clear, palatable, soft water.
- On prolonged storage algae and other vegetarian grow inside the water.

- **Rivers :**
- Many cities depends on rivers as a source of water .
- The river water is turbid in rainy season, contains dissolved and suspended impurities, because of various human activities, industrial waste, surface washing .
- The bacterial count is usually more,

  natural purification of rivers carried out by sunlight

- **Tanks :-**
- Tanks are source of water collection mostly in villages. T
- hey are contaminated mainly due to they are used for various activities like cloth washing, swimming, animal entry,
- Tanks are subjected to unlimited possibilities of so, contaminations and are highly dangerous as a source of drinking water.
- But it can be prevented by taking caution.

Ground Water :-

- Ground water is the cheapest and most practical means of providing Water to small communities.
- Ground water is superior to surface water. Because act as filter itself.
- The usual ground water sources are wells and springs.
- Wells have been classified into;
  - — Shallow wells
  - - *Deep* wells
  - — Dug wells
  - — Tube wells.

The advantages of ground water are

- It is likely to be free from pathogens,
- Usually requires no treatment,
- Certain supply.

The disadvantages are

- High mineral content,
- Requires lifting arrangement to water,

- **Springs**:

  The amount of water is small and their location is not always convenient so they are not considered as important source of water.

Sources of water pollution are:-

Gases :- hydrogen sulphide, carbon-dioxide, oxygen, ammonia and nitrogen.

Chemicals :- Sulphates and carbonates of calcium and magnesium

- Suspended clay
- Sand or mud and micro-organism of plant and animal origin.
- Rapid urbanization and industrialization is posing much greater risk of water pollution and it is dangerous.
- The water from sewage system may pollute water which Might contain pathogenic organisms and toxic chemicals like pesticides, fertilizers, radioactive substance', and some complex organic chemicals.

Hazards of water pollution :

- The hazards of water pollution may be classified into two
- groups - Biological and Chemical.

Biological hazards:-

These comprise the water-borne diseases caused by the presence of an infective agent

- Bacterial diseases, e.g. Cholera, Bacillary dysentery, infantile diarrhoea.
- Viral diseases, e.g. Viral hepatitis, poliomyelitis.
- Protozoal diseases, e.g. Amoebiasis, girardiasis.
- Worm infestations, e.g. Roundworm, whipworm
- Hectospiral, e.g. Weils disease.
- Cyclops causing diseases, e.g. Guinea worm,

- **Chemical hazards :-**
- A water may be polluted by different chemicals which may affect man's health not only directly but also indirectly by accumulating in aquatic life used as human food.
- Chemical pollutants may show acute toxic effect but it may cause long term effects of low level exposure which are often nonspecific and difficult to detect.
- The other problem associated with water is "Hardness" which presents several disadvantages to domestic and industrial consumer

Hardness of water

- Hardness may be caused mainly by calcium bicarbonate, magnesium bicarbonate, calcium sulfate, or magnesium sulfate. Chlorides and nitrates of calcium, and magnesium can also produce hardness.

- Hardness can be of two types carbonate (temporary) hardness
- Non-carbonate (permanent) hardness.

- The carbonate hardness is produced due to the presence of bicarbonates of calcium and magnesium.

- while non-carbonates hardness is due to sulfates, chlorides and nitrates of calcium or magnesium.

- Drinking water should be moderately hard.

- Hardness in water is expressed in milli equivalents per litre (mEg/l).

- When hardness *exceeds* 3mEg/l, softening of water is recommended.

- **Disadvantages of hard water:**
- When the water is polluted by different chemicals it may affects human health directly or indirectly by accumulating in body.
- It may cause long term effects of low level exposure which are often non-specific and difficult to detect.
- The hardness of water presents several disadvantages to domestic and industrial consumer,

Water pollution can be prevented by Purification of water.

Water purification on small scale :-

- Boiling
- Chemicals Bleaching powders, chlorine tablets, High hypochlorite (HTH), Iodine, Potassium permanganate.
- Filtration

Water purification on large scale :-

- Storage
- Filtration :- Slow sand filters, rapid sand filters
- Chlorination.

method used for purification of water on large scale.

- The water on large scale, such as an urban water supply is purified in 3 main stages;
- 1) Storage, 2) Filtration , 3) Chlorination,

1) Storage:-

- Water drawn from the source is stored in natural or artificial reservoirs.
- Storage prevents further contamination or pollution considerable amount 'of purification of water occurs during storage.
- About 50 percent suspended impurities settle down in 24 hours due to gravity. The water becomes clearer.
- Certain chemical changes also take place during storage. Storage may reduce total bacterial count.
- The optimum period of storage of river water is 7 to 14 days.

- Filtration is 2nd stage in purification of water and quite an imp stage because 99% of bacteria are removed by filtration.

Two types of filters are in use.

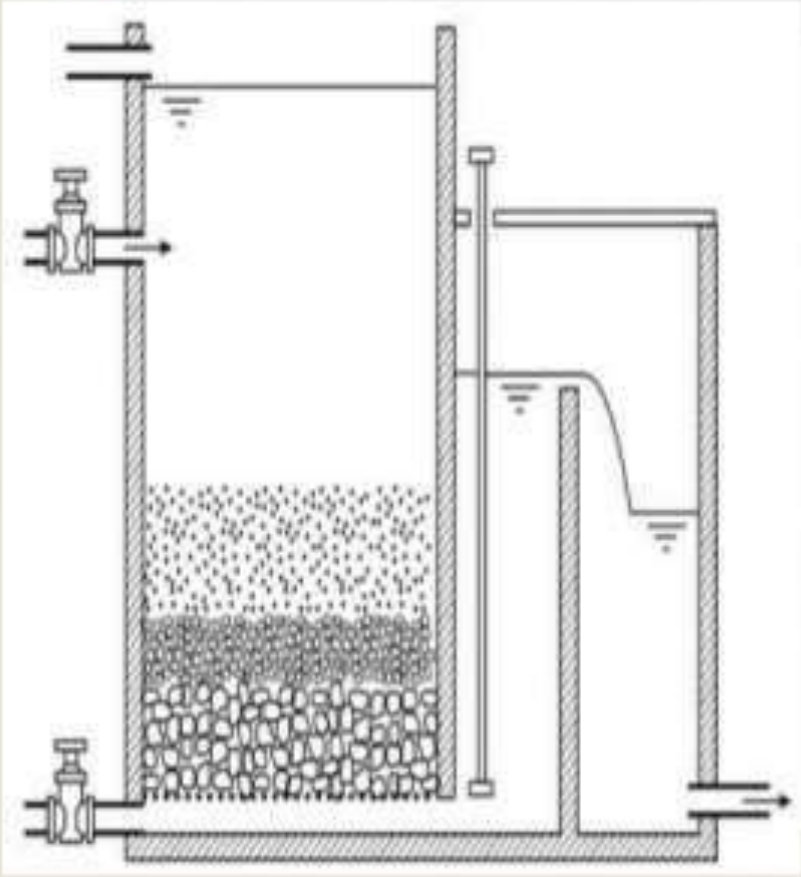
- Biological or slow sand filters
- Mechanical or rapid sand filters.

Mechanism of working of sand filters

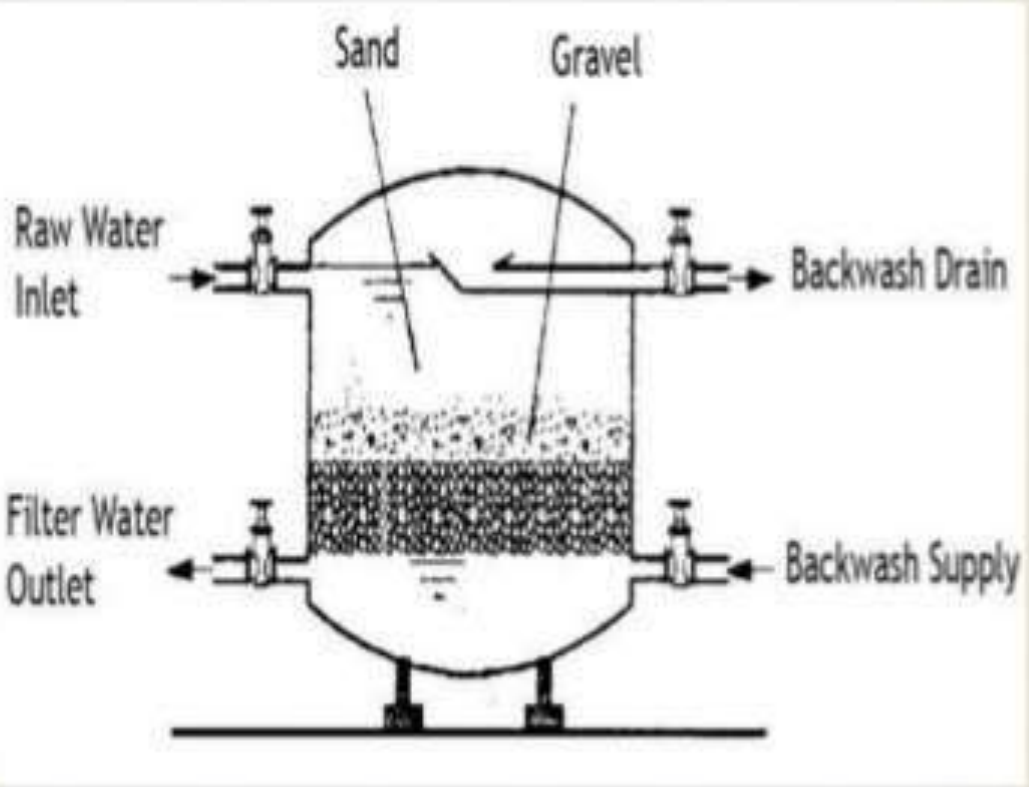
- Waste water having full sludge is pour in sand filter.
- Sludge stick at sand.
- Water move using gravity force or pressure force .
- Filtrate move to the next step.

Type of sand filter:

- Slow sand filter



- Rapid sand filter



rapid sand filter

Rapid sand filter:- There are two types of rapid sand filters.

- Gravity type, e.g. Paterson's filter
- Pressure type, e.g. Candy's filter.

The Paterson's filter is most commonly used. During rapid filtration, five steps are involved which are as follows.

- **Coagulation:-** Here the water is treated with a chemical coagulant such as alum to remove turbidity and colour.
- **Mixing:** Mechanical mixing is done in a mixing chamber so as dissolve the alum and precipitate the impurities.
- **Flocculation:** In a flocculation chamber water is stirred at slow speed for about half an hour so as to form floccules of aluminium hydroxide.

- **Sedimentation:**

  The coagulated water is then led to sedimentation tank where the precipitates are allowed to settle at bottom of tank and taken out.

- **Filtration:**

  Filtration is the most important step in rapid sand filtration process.

  The clarified water is led to rapid sand filter which purifies water from 98-99 percent.

Chlorination :-

- Chlorination is used as -supplement to sand filtration.
- Chlorine kills pathogenic bacteria but it has no effect on spores and certain viruses (e.g. viral hepatitis, polio) except in high doses.
- Chlorine has few other important secondary properties of value in water treatment such as, it oxidizes iron, manganese, Hydrogen sulphide, it destroys some taste and odour-producing constituents,

Method of chlorination

- For disinfecting large quantities of water chlorine is applied either as
- Chlorine gas
- Chloramine
- Perchloron (bleaching powder).

- The minimum concentration of free chlorine is 0.5 mg/ litre for 1 hr.
- Apart from chlorination, ultraviolet radiation are also used as germicidal agents but their use is limited.

Purifying water on small scale.

- Three methods are generally available for purifying water on small scale. These methods can be used in combinations

a) Boiling :-

- Boiling the water for 5 to 10 minutes is a satisfactory method of purifying water for household purpose it kills, bacteria, spores, cyst, ova, and yields sterilized water.
- It also removes temporary hardness.
- Water should be boiled Preferably in same container, in which it is to be stored to avoid contamination during storage.

b) Chemical Disinfection :

Bleaching powder OR Chlorinated lime:

- It contains 33% of available chlorine. To prevent chlorine loss, it is mixed with excess of lime this is called stabilized bleach.
- The amount of bleaching powder should be sufficient chlorination is to ensure a "free" residual chlorine of 0.5 mg/litre at the end of one hour contact.

chlorine tablets :

- Apart from bleaching powder, chlorinated solution, chlorine tablets are available in markets which are used to disinfect water.
- One such tablet of 500mg is sufficient for 2 lit. water

Iodine

- may be used for emergency disinfection of water.
- Two drops of 2 % solution of iodine in ethyl alcohol can disinfect one lit of water within 20 to 30 min

Potassium permanganate:

- It is powerful oxidising agent and can kill cholera virus but of little use for other microorganism
- Now not preferred for disinfection.

High Test Hypochloride HTH:

- This is calcium compound
- Also called as perchloron , containing 60-70% of chlorine

- **Filtration:-**

- Water can be purified on a small scale by filtering through ceramic filters such as
- Pasteur chamber land filter, and
- katadyn filters.
- These filter candles usually remove bacteria found in drinking water but not filter passing viruses.
- Filter candles can be logged with impurities of water hence cleaned every week by scrubbing and boiling

- Apart from candle filters, on-line filters with bacteria retentive capacity are available which may be incorporated in water line or fitted to tap. They require frequent change of filters. (Zero B- filters).

- **Disinfection of Wells :-**
- Wells are the main source of water supply in rural areas. The most effective and cheapest way of disinfecting wells is by bleaching powder.
- Volume of water calculated first then amt of bleaching powder required is calculated

Qualities of water

- If water will be used for domestic purpose bacteriological and chemical qualities should be very high but for agricultural purposes the quality required is not so important,

- Physical quality:
- The water used for domestic purposes should not have any colour, smell, turbidity and the taste should be agreeable.

Chemical qualities :

- There are some chemicals which are normally present in water and if their level is within the acceptable limit the water is not harmful.
- Chlorides of calcium and magnesium are permissible from 200 mg per litre to 600 mg per litre;
- Some amount of dissolved and adsorbed oxygen is also present in water.
- Some chemicals like nitrites, ammonia and other sub should not be present in drinking water and if they are present the water has been polluted.

BACTERIOLOGICAL QUALITY

- Some bacteria from faecal origin can contaminate water and remain in water for sometime, so their presence indicates faecal pollution.
- E.g.
- Coliform organisms
- Faecal streptococcus.
- Clostridium perfringens

- In four test tubes measured volume of sample water is taken (0.1, 1.0, **10,** 50 ml).
- This is inoculated with McConky's lactose bile salt broth.
- The indicator bromocresol purple is also added. In each test tube is placed a small inverted tube.
- After 48 hours inoculation in the incubator the tubes are watched for the appearance of colour change and gas in the smaller inverted tubes.

- Colour change indicates acid production
- If acid and gas is produced it is assumed that the sample water contained coliform organisms.
- The test is considered confirmatory and usually no further testing is done.
- In addition to coliform organisms water may contain algae, fungi, protozoa, cyciops, mosquito larva etc.
- they give a bad taste, colour and smell

Air

- Air is vital for life. Clean air is nessesary for healthy life

Composition of air

- Nitrogen 79%
- Oxygen 20.95%
- Carbon dioxide 0.03%
- Hydrogen and other gases

When the concentration of gases other than oxygen increase in air , the air is said to be polluted.

The main pollutant of air are carbon dioxide, carbon monoxide, hydrogen sulphide, other organic sulphides, fluorine compounds, benzpyrenes, radio active substances.

Health effect of Air pollution :

- Polluted air affects respiratory function, causes bronchitis, lung, carcinoma, sore throat, cough, wheezes, eye irritations, pollen allergis, etc.
- Polluted air also affects animal and plant life.
- It causes contamination of upper atmosphere and the alteration of whether and climate.

Air-borne Diseases *:-*

- As the result of air pollution the following diseases may spread: Tuberculosis, diphtheria, measles, chicken pox, whooping cough, pneumonia, etc.

Prevention and control :-

- For the control of air pollution following procedures are recommended.

- **Containment :-** It means try to stop the release of toxic substances into the air by measures like providing enclosure, ventilation, and air cleaning.

- **Replacement :-** coal can be replaced by natural gas or electricity to prevent air pollution.

- **Dilution :-** The contaminants present in the air are diluted by ventilation and plantation.

- **Legislation control :-** Many countries have adopted legislation to control air pollution. In india there is " smoke Nuisance act" which is effective in big cities. The vehicles must be checked frequently for proper maintenance so that they cause minimum pollution.

Disinfection of Air :- Disinfection of air, if necessary, may be carried out by following methods

- Mechanical ventilation
- Ultraviolet radiation.
- Chemical mists, i.e. use of air bactericides such as, Triethylene glycol vapours
- Dust control

Ventilation:

- When the amount of solid waste or concentration of gases other than oxygen increase in air, the air is sa**id** to be polluted.
- The polluted air from closed area or room may be diluted with a fresh air coming from the openings provided in the room.
- Such openings are termed as ventilation.
- They also help to improve lighting conditions; ventilation may be of following types-

- Ventilation provided in the form of a window,
- Cross ventilation,
- Ventilation by an efficient exhaust system,
- Mechanical ventilation.

Lighting

- For good visibility proper lighting nessesary otherwise there is eye strain which ultimately leads to headache. tiredness and loss of efficiency.
- Good lighting means that the light should be sufficient for visibility and should not cause eye strain.
- light source should have uniform light that means it should not flicker.

- Natural light is derived from the sun.
- For proper lighting windows should be provided in the room.
- Artificial lighting is required during nights and cloudy days. It **may** be direct or indirect.
- Direct light means that the source projects light directly to the working area as in the case of table lamp directed towards working. area.
- Indirect light is put on some object then it is reflected towords the working area.
- Direct light is bright and if intensity is high it may cause *eye* strain and it is only useful for very tine work.
- indirect light is diffuse in nature and good for general illumination, the light is directed towards the *ceiling* or upper parts of the wall and room gets indirect light or reflected

Health effects of light

- The premature newborn children having physiological jaundice if exposed to light recover soon, vitamin D is synthesized under the influence of light in the body. ⁻

ill-effects of sun light

- The ill-effects of sunlight are eye-strain, skin-darkening, skin burn and even skin cancer.

Various methods to control sun-light effects are :-

- Use sun goggles for the protection of eyes from UV rays.
- Use sun-screen lotion al ! ointments before going into the sun-light, which protects the body
- Wear hand -gloves, hats, etc.
- For proper lighting windows ,should be provided in the rooms. The number of location and area of the windows depends upon the use of the room.
- When light enters the rooms, it is reflected from the ceiling walls and objects, so white ceiling and light coloured walls are for good lighting.

Noise

- Noise is often defined as "unwanted sound". But a better definition of "Noise" is "wrong sound in wrong place at wrong time".
- **Sources :-**
- The sources of noise are many and varied.
- These, are automobiles, factories; industries, air—crafts, domestic noises from radio, Televisions, transistors, etc.

- **Properties :-** Noise has two important properties

Loudness or intensity :

- Loudness or intensity depends upon the amplitude of Ovations, which initiated the noise.
- The loudness is measured in decibels (dB).
- A daily exposure to about 85 dB is considered as the limit people can tolerate without substantial damage to their hearing.

Frequency :

- frequency is denoted as hertz (Hz).
- The human ear can hear frequencies from about 20 to 20,000 Hz
- but this range is reduced with age and other subjective factors.

- The effects of noise exposure are of two types
- Auditory and
- Non-auditory.

I) Auditory effects :

- **Auditory fatigue:**

It appears in 90 dB Loudness region and is greatest in 4000 Hz.

- **Deafness :** Permanent or temporary deafness may occur due continuous or repeated exposure to high noise.

II) Non-Auditory effects :

- These are distinguished as follows:.
- **Interference with speech .**

- **Annoyance :** This is primarily a psychological response.

- **Efficiency :** For mental concentration, low level of noise is desired

- **Physiological changes :**

  A number of physiological changes occur in human body as a direct result of direct noise exposure.
- These are a rise in blood pressure,
- an increase in heart rate and breathing,
- increased sweating.
- Noise interferes with sleep.

Noise Control :

Noise cannot be totally eliminated, however, it can be reduced.

Noise control may be achieved by

- Control of noise at source.
- Protection of exposed persons.
- Education of people about noise hazards.
- Legislation (law) control.

Solid waste

- Solid waste is the unwanted waste material from the industries, houses, streets, and agriculture activities.
- It is harmful to human health because when it decomposes and ferments it attracts flies, rodents, pigs.

Solid Waste Management

- Solid waste management is a term that is used to refer to the process of collecting and treating solid wastes.
- It also offers solutions for recycling items that do not belong to garbage or trash.

- **Need for Solid Waste Management**
- Rapid population growth and urbanization in developing countries has led to people generating enormous quantities of solid waste and consequent environmental degradation.
- Management of solid wastes is important in order to minimize the adverse effects posed by their indiscriminate disposal.

Sources of Solid Waste

There are two major sources of solid waste – **Urban wastes** and **Industrial wastes**

Urban wastes

include the following wastes:

- **Domestic wastes**:

  containing a variety of materials thrown out from homes Ex: Food waste, Cloth, Waste paper, Glass bottles, Polythene bags, Waste metals, etc.
- **Commercial wastes**:
- it includes wastes coming out from shops, markets, hotels, offices, institutions, etc. Ex: Waste paper, packaging material, cans, bottle, polythene bags, etc.
- **Construction wastes**:

  It includes wastes of construction materials. Ex: Wood, Concrete, Debris, etc.
- **Biomedical wastes**:

  It includes mostly waste organic materials Ex: Anatomical wastes, Infectious wastes, etc.

Sources of Industrial wastes :

The main source of industrial wastes are chemical industries, metal and mineral processing industries. Ex:

- **Nuclear plants**: It generates radioactive wastes
- **Thermal power plants**: It produces fly ash in large quantities
- **Chemical Industries**: It produces large quantities of hazardous and toxic materials.
- **Other industries**: Other industries produce packing materials, rubbish, organic wastes, acid, alkali, scrap metals, rubber, plastic, paper, glass, wood, oils, paints, dyes, etc.

Steps involved in Solid Waste Management

- Two important steps involved in solid waste management are:
- Three R's – **Reduce, Reuse** and **Recycle** of Raw Materials
- **Reduction in use of raw materials**: Reduction in the use of raw materials will correspondingly decrease the production of waste. Reduced demand for any metallic product will decrease the mining of their metal and cause less production of waste.

- **Reuse of waste materials** : The refillable containers which are discarded after use can be reused. For ex: Making rubber rings from the discarded cycle tubes which are used by the newspaper vendors, instead of rubber bands, reduces the waste generation during manufacturing of rubber bands.
- **Recycling of materials**: Recycling is the reprocessing of discarded materials into new useful products.
  Ex: Old aluminium cans and glass bottles are melted and recast into new cans and bottles
- This method (Reduce, Reuse & Recycle), i.e, 3R's help save money, energy, raw materials and reduces pollution.

Discarding of wastes

The following methods are adopted for discarding wastes:

- Sanitary Landfill
- Incineration and
- Composting
- Dumping

SANITARY LANDFILL :

- This is the most popular solid waste disposal method used today.
- Garbage is basically spread out in thin layers, compressed and covered with soil or plastic foam.
- Modern landfills are designed in such a way that the bottom of the landfill is covered with an impervious liner which is usually made of several layers of thick plastic and sand.
- This liner protects the ground water from being contaminated because of leaching or percolation.
- When the landfill is full, it is covered with layers of sand, clay, top soil and gravel to prevent seepage of water.

Advantages:

- It is simple and economical
- Segregation of wastes is not required
- Landfilled areas can be reclaimed and used for other purposes
- Converts low-lying, marshy waste-land into useful areas.
- Natural resources are returned to soil and recycled.

Disadvantages:

- Large area is required
- Land availability is away from the town, tansportation costs are high
- Leads to bad odour if landfill is not properly managed.
- Land filled areas will be sources of mosquitoes and flies requiring application of insecticides and pesticides at regular intervals.
- Causes fire hazard due to formation of methane in wet weather.

- **INCINERATION:**
- In this method municipal solid wastes are burnt in a furnace called incinerator.
- Combustible substances such as rubbish, garbage, dead organisms and non-combustible matter such as glass, porcelain and metals are separated before feeding to incinerators.
- The non-combustible materials can be left out for recycling and reuse.
- The leftover ashes and clinkers may account for about 10 to 20% which need further disposal by sanitary landfill or some other means.
- The heat produced in the incinerator during burning of refuse is used in the form of steam power for generation of electricity through turbines.

Advantages

- Residue is only 20-25% of the original and can be used as clinker after treatment
- Requires very little space
- Cost of transportation is not high if the incinerator is located within city limits
- Safest from hygienic point of view
- An incinerator plant of 3000 tonnes per day capacity can generate 3MW of power.

Disadvantages:

- Its capital and operating cost is high
- Operation needs skilled personnel
- Formation of smoke, dust and ashes needs further disposal and that may cause air pollution.

COMPOSTING

- Due to lack of adequate space for landfills, biodegradable yard waste is allowed to decompose in a medium designed for the purpose.
- Only biodegradable waste materials are used in composting.
- Good quality environmentally friendly manure is formed from the compost and can be used for agricultural purposes.

Advantages:

- Manure added to soil increases water retention and ion-exchange capacity of soil.
- This method can be used to treat several industrial solid wastes.
- Manure can be sold thereby reducing cost of disposing wastes
- Recycling can be done

Disadvantages:

- Non-consumables have to be disposed separately
- The technology has not caught-up with the farmers and hence does not have an assured market.

Dumping :

- Refuse is dumped in low lying areas.
- This is mainly easy method of disposal of dry refuse.
- But this method is considered as most
- in-sanitary method that creates public hazards and pollution of the enviroments.

Burial :

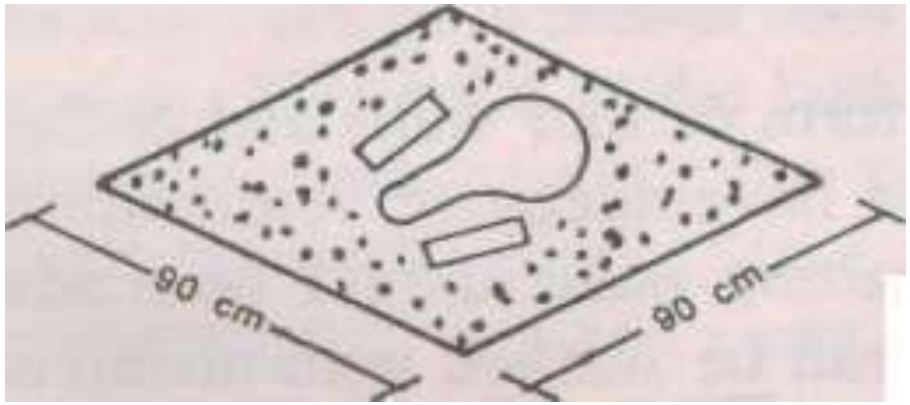
- Burial method of disposal is suitable for disposal of refuse of the village or small settlements.
- This could be undertaken in an area if sufficient land is available.
- The method is similar to sanitary landfill and the involves digging a trench 2 m deep and 1.5 m wide in which the refuse from the village or camp is deposited and at the end of the day the refuse is covered with 20 to 30 cms of earth.
- The disposal continues in this manner till the time the level in the trench is 40 cms from ground level, when the trench is filled and compacted and a new trench is dug out.
- The waste matter is decomposed in 4 to 6 months time when it can be taken out and used as manure in the fields.
- A trench of this size and 1 m long would suffice for 200 persons for a week

Manure pits :

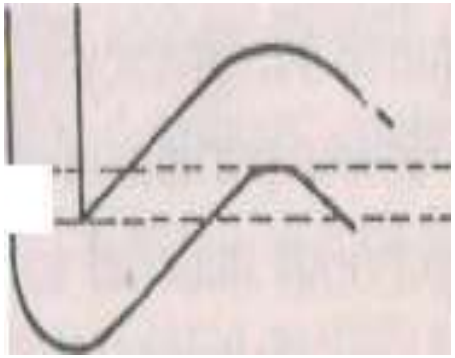
- This method of waste disposal could be practised by the individual households in the rural areas.
- Pits could be dug near the house and the wastes such as kitchen wastes, cattle dung, fodder or animal feeds, leaves could be thrown into them.
- Two such pits could be dug simultaneously of 1 to 1.5 m and used one at a time.
- When one pit is filled up it is covered with a top layer of soil and compacted.
- In 5 to 6 months time, the wastes are decomposed and converted into manure, which could be returned to the fields

RCA latrine

- The RCA latrine comprises of a squatting plate, made of an impervious material like cement concrete.
- This is easy to clean and maintain.
- Raised footsteps are included in the squatting plate.
- There is a pan directly underneath the squatting plate. The pan receives the night soil.
- Pan is connected to the trap, which is a bent pipe.



Squatting plate



Trap **Pan**

- The trap holds water and serves as a water seal.
- The depth of the water seal is 2 cm.
- The trap is connected to the pit through a connecting pipe.
- When the pit fills up another one can be dug up and pipe may be accordingly shifted.
- The pit can also be made directly underneath the pan.
- An appropriate superstructure can be made.

- It is easy to maintain the latrine.
- Latrine is hand flushed by pouring 1 to 2 lit of water every time the latrine is used.
- The squatting plate should also be washed clean every day.
- Water seal prevents access to flies and avoids release of odour

Design and Construction

- Septic tank consists of an underground concrete tank usually double chambered.
- The latrines should preferably be grouped together with one or more tanks placed close to a group.
- The sewers leading from the latrines to the tanks should have manholes at every 100m and at every change of direction.
- Two or more medium sized tanks arranged in parallel instead of one large tank are preferable – facilitate removal of sludge without disturbing the functioning of the system.

Septic Tank

- Capacity of tank:200,000 liter

1000 Lit. per person should be there

- 1.5 to 2m deep. ,
- Minimum air space of 30 cm above the liquid level.
- The septic tank is covered by a concrete slab with a manhole in it.
- The aeration chamber should be ventilated.
- The inlet and exit pipes to the tank should be trapped.
- The effluent may be disposed into a soak-well

Functioning

- The septic tank functions by the biological process of anaerobic and aerobic digestion
- The crude sewage on entry to anaerobic chamber allowed to stand for 2 to 3 days and is acted upon by the anaerobic microorganisms.
- A partially digested colloidal solution is formed.
- The complete oxidation and mineralization of the colloidal matter is carried out by the aerobic micro-organisms in the aerobic chamber.
- The effluent loses most of its offensive smell.
- The minerals are absorbed from the soil by the plants.

Sewage

- **Sewage:**

  It contains waste water, excreta, industrial waste and waste water from public places.

The sewage contains billions of microorganisms which must be destroyed ,

The sewage contains organic matter , which must be oxidized & to do so,

Sewage must be passed through the process named sewage treatment:

- **Biological Sewage Treatment: —**
- In modern sewage plants certain biological and chemical changes take place.
- The processes are aerobic and anaerobic decomposition of the organic matter by bacteria present in it.
- The big solid particles are removed by screening and sedimentation.
- The sewage treatment procedure is a continuous process and technically the whole treatment in divided into two stages ;
- first stage is called the primary treatment and
- the secondary stage the secondary treatment.

- **Primary treatment : —**
- It includes the removal of big solid objects and sedimentation associated with anaerobic digestion.
- It is carried out in two different steps.

(a) Screening

(b) Grit settling chamber

(a) Screening: —

- sewage from the public sewers is passed through a screen made of steel bars.
- to remove floating wood, dead animals or any other big object.
- Sometimes a second screen is also placed after the first with the bars close to each other only at a distance of 2 cm to further screen out the sewage.
- Screening is essential otherwise the big objects might Interfere with the subsequent treatment.

b) **Grit settling chamber: —**

- The screened sewage is allowed to pass through a long chamber of 10-12 metres in length slowly so heavy particles like sand, small stones, grit, etc. settle down at bottom.
- The settled material is removed from the chamber and disposed of by burying.
- The remaining sewage which contains relatively more organic matter passes to the next chamber

Primary sedimentation tank: —

- **It** is a very huge tank for sedimentation of solid particles. This is called primary sedimentation through this tank sewage is allowed to flow very slowly so that sedimentation can take place sufficiently.
- Suspended particles settle down at the bottom and biological action also takes place in the presence of bacteria.
- It is mainly decomposition of organic matter into simple compounds.
- The sediment called 'sludge' is removed periodically from the bottom and disposed of by trenching.
- If sewage contains industrial wastes also chemical treatment of the sewage is done in this chamber.
- The effluent from the primary sedimentation tank undergoes secondary treatment.

Secondary treatment: —

- The sewage from the primary treatment chambers contains colloidal substances. It still needs treatment.

- The first step in the secondary treatment is subjecting it to **aeration** (is the process by which air is circulated through, mixed with or dissolved in a liquid or substance.) so that biological activity is quicken.

It is done by the following methods:

- **Trickling filter**
- **Activated sludge process**
- **Secondary sedimentation**

Trickling filter: —

- A circular filter bed is constructed made of small stones. Its height is 1-2 metres and diameter depends upon the amount of sewage.
- The sewage is spread on this filter bed by mechanical rotators continuously in small amounts.
- Biological process starts with the help of bacteria, algae, fungi, and protozoa in the presence of sunlight.
- The stones provide a large surface area for adsorption and oxidation.
- Collectively the whole procedure includes destruction of microorganisms, oxidation of organic matter, adsorption of impurities, etc.
- The sewage now left is comparatively harmless.
- The layer of solid material over the filter bed is green slimy material removed mechanically.
- Trickling filter is the old and widely used method.

Activated sludge process: —

- This is comparatively modern method but the mechanism of operation is same, the aeration sewage.
- There is a big aeration tank in which either it is agitated mechanically or all is forced from the bottom.
- Before aeration sewage is mixed with some amount of sludge from the last sedimentation tank.
- Because it contains many aerobic bacteria which can decompose organic matter in the aerated sewage.
- Whether it is trickling filter or activated sludge process it reduces the bacteria to a great extent, much of the organic matter gets oxidised. The liquid now left is not having offensive smell and it is not very harmful

- **Secondary sedimentation: —**
- The sewage from the trickling filter is led to a sedimentation tank called secondary sedimentation tank.
- It is allowed to stand for 2-3 hours.
- The sediment is called the 'aerated sludge or activated sludge' used in activated sludge process and it is entirely different from the sludge of primary sedimentation tank.
- The activated sludge is excellent manure and is not harmful

Sludge digestion: —

- The sludge from secondary sedimentation tank is black tarry material with a bad smell.
- It is disposed of by various methods.
- One of them is incubating it at a proper temperature so that it gets decomposed naturally and forms simple substances and the residue is dried and used as manure.
- The byproducts are methane, water and carbon dioxide.
- Methane can be used for heat and light production.
- The sludge can also be disposed of in the sea or composted with the refuse.

Effluent disposal: —

- The liquid after secondary sedimentation still left.
- It can be disposed of in the river or sea.
- If it is disposed of In the river it should fulfill some criteria as river water is used for drinking.
- It should not contain suspended particles in a concentration 30mg/litre or more.
- The river should dilute the effluent at least in ratio 10: 1.
- The effluent can be used for irrgation purposes directly.

Alternate Methods of Sewage Disposal

Sea and river outfall: —

- Sea coast cities like Bombay are discharging most of its sewage directly into the sea.
- With such a large volume of water it gets diluted and natural biological processes ultimately do the purification.
- For river outfall the sewage must be partly treated.
- This treatment depends upon the type of sewage and dilution capacity of the river.

- **Sewage farming: —**
- The sewage after primary treatment may be used to irrigate land in some cities.
- Precaution must be taken that crops should not come in direct contact of sewage, rainy seasons is not suitable for this method.
- The whole operation should be supervised and all possibilities of crop contamination should be eliminated

Oxidation pond: —

- It is a big pond 1 to1.5 metre deep
- containing algae and bacteria and exposed to direct sunlight.
- The mechanism of operation is purely natural method which kills microorganism, oxidises organic matter in presence of sunlight and bacteria.
- The process is aerobic in sunlight and sometimes later also then anaerobic process starts because algae produce oxygen only in the presence of sunlight which is ultimately used in the aerobic process.
- The effluent water from the tanks can be used for irrigation.

Medical Entomology

Medical Entomology

- There are few arthropods in the environment which bite 0r infest man and transmit disease. A study of these arthropods is **known** as "Medical Entomology".
- arthropods : are a large group of invertebrate animals. Insects, spiders, crabs, shrimp, millipedes, and centipedes are all **arthropods**.

The following are some examples of arthropods and the uses transmitted by them :

Arthropods	Diseases transmitted by them
Mosquito	Malaria, Filaria, Encephalitis, yellow fever.
Housefly	Typhoid, paratyphoid, cholera,diarrhoea, amoebiasis.
Sand fly	Kala-azar, sand fly fever.
Louse	Epidemic typhus, Trench fever.
Rat flea	Plague.
Itch mite	Scabies.
Cyclops	Guinea worm disease.

There are 3 ways in which arthropods transmit disease :

Direct contact :

- Some arthropods transmit disease by direct contact.
- For example, Itch mite which causes scabies is spread by direct contact.

Mechanical Transmission :

- Some arthropods spread disease mechanically by carrying the infection on their body.
- For example various diseases spread by House- fly.

Biological Transmission :

- The disease agents multiplies or develops in the insect host and then carried to human host, this is known as biological transmission.
- For example malaria, and filaria by mosquitoes.

- The arthropod or insect-borne diseases are controlled by the following four methods,

Environmental control : -

- The environment should be maintained neat and clean by means of good drainage, and disposal of waste and sewage in order eliminate breeding places

Chemical control : -

- Arthropods are killed by spraying insecticides e.g. DDT, Sulphur di-oxide, BHC, Pyrethrum, Formaline etc.

Biological control :-

- Arthropods may be destroyed by various biological control methods such as by cultivating larviovorous fishes (e.g. Gambusea) and fungi (e.g. Coelomomysis) which eat arthropods.

Genetic control :-

- Genetic control of transmission of diseases by arthropods includes methods such as sterile male technique and chromosomal translocation methods.

Insecticides :- It is an agent or chemical substance which kills insects.

Classification of Insecticides :-

Insecticides of a wide variety are available now a days for spraying houses and cattle sheds.

- DDT **:** in the conc. of 1-2 gms/sq.meter area.
- Malathion
- Lindane
- Dimethoate
- Fenthion
- Benzyl benzoate

- Mosquito repellents
- A) Diethyl toluamide

- Mineral oil like kerosine spread over the water surface eali prevent the supply of air to the larve and they are killed.

- **Pesticides :-** An agent or chemical substance which kills pests.

Rodents

Mice, rats, etc. are some of the examples of rodents
Rodents are associated with a number of diseases.

These are :

- **Bacterial diseases :** e.g. Plague salmonellosis etc.
- **Viral diseases :** e.g. Encephalitis, Haemorrhagic fever, etc.
- **Rickettsial diseases:** e.g. Scrub, Typhus, etc.
- **Parasitic diseases :** e.g. Amoebiasis, Trichomoniasis etc.
- **Other diseases :** e.g. Rat bite fever, Ring worm infection.

Rodents and the disease caused by them are controlled by following ways :

Preventing the growth and multiplication of rodents by :

- Maintaining clean environment,
- Construction of rat proof houses, and
- Closing rat holes,
- Improvement of sanitation.
- Trapping rats by using trap boxes and destroying the trapped **rats** by immersing in water.
- By fumigation using chemicals like calcium cyanide.
- By using rodehticides or Rat poison like red squill, zinc hosphide.