

DISPOSAL OF HUMAN EXCRETA IN UNSEWERED AREAS

Dr Nikita Sharma
AP, Community Medicine Dept.

Definition of Excreta

Waste matter discharged from the body, especially feces and urine.

Human waste (Human excreta) refers to the waste products of the human digestive system and the human metabolism, namely feces and urine.

Definition of sanitation

Sanitation is a measures of promoting health through prevention of human contact with the hazardous wastes as well as the treatment and proper disposal of waste-water.

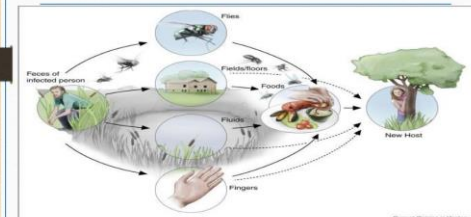
Definition of sanitation

According to World Health Organization, Sanitation is the provision of facilities and services for the safe disposal of human urine and feces and maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal.

Health hazards of improper excreta disposal

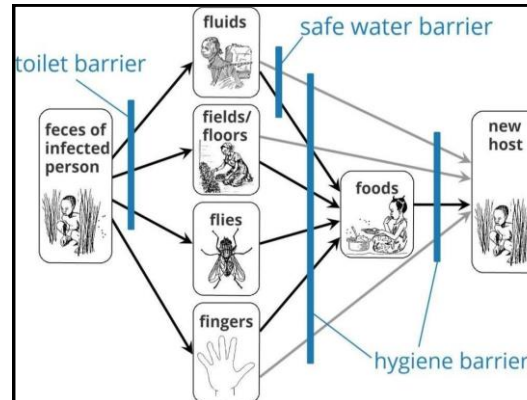
- ❖ *Soil pollution.*
- ❖ *Water pollution*
- ❖ *Contamination of foods*
- ❖ *Propagation of flies*

Spread of disease from excreta



Sanitation Barriers

Over 90% of the cause of diarrheal deaths is **unsafe drinking-water, poor sanitation, and insufficient hygiene**. Human and animal feces are the main source of diarrheal pathogens. These bugs enter the environment when people and animals defecate, and are then spread to other humans by fingers, flies, in fluids (mostly water), and via surfaces, such as fields.



Methods of excreta disposal

Unsewered areas

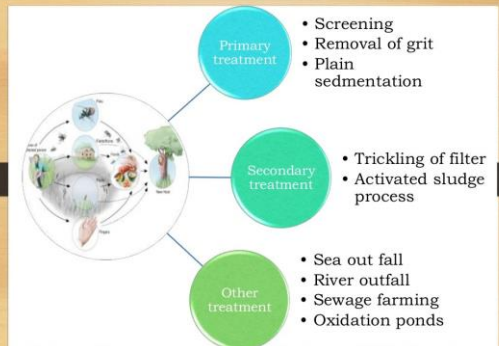
- ❖ Service type latrines (conservancy system)
- ❖ Non service type (sanitary latrines)
- ❖ Latrines suitable for camps and temporary use.

Non service type(sanitary latrines)

1. Bore hole latrine
2. Dug well latrine
3. Water seal latrine
 - ❖ PRAI type
 - ❖ RCA type
 - ❖ Sulab shauchalaya
4. Septic tank
5. Aqua privy

Latrines suitable for camps and temporary use

- ❖ Shallow trench latrine
- ❖ Deep trench latrine
- ❖ Pit latrine
- ❖ Bore hole latrine

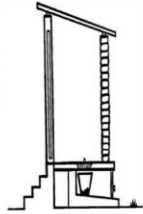


Cartage (Conservancy system)

Example: Bucket latrine

Disadvantages:

- ❖ Smell
- ❖ Flies
- ❖ Health risk to people handling the excreta
- ❖ Health risk from food crops fertilized with raw excreta



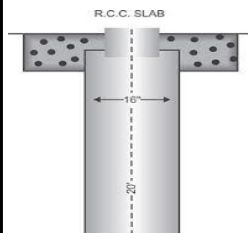
Criteria for a sanitary latrine

- ❖ Excreta should not contaminate the ground and surface water.
- ❖ Excreta should not pollute the soil.
- ❖ Excreta should not be accessible to flies, rodents, animals
- ❖ Excreta should not create a nuisance due to odor or unsightly appearance

Bore hole latrine

- ❖ First introduced by Rockefeller Foundation during 1930 in campaigns of hook worm control.
- ❖ The latrine consists of a circular hole 30 to 40cm in diameter, dug vertically into the ground to a depth of 4 to 8m, most commonly 6m.
- ❖ A concrete squatting plate with a central opening and foot rests is placed over the hole.
- ❖ A suitable enclosure is put up to provide privacy

BORE HOLE LATRINE



Bore hole latrine

Merits

- ❖ No need for the services of a sweeper for daily removal of night soil.
- ❖ Unsuitable for fly breeding
- ❖ If located 15 m away from source of water supply, there should be no danger of water pollution.

Bore hole latrine

Demerits

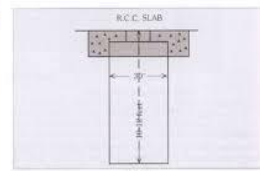
- ❖ Small capacity.
- ❖ A special, the auger is required for the construction which may not be readily available.
- ❖ In many places, the subsoil water is high and the soil loose with the result it may be difficult to dig a hole deeper than 3m.

Dugwell latrine

- ❖ A circular pit about 75 cm in diameter and 3 to 3.5 m deep.
- ❖ The pits may be lined with pottery rings to prevent caving in of the soil.
- ❖ A concrete squatting plate is placed on the top of the pit and the latrine is enclosed with a superstructure.

DUG WELL LATRINE

Dug Well Latrine



Dugwell latrine

Advantages

- ❖ It is easy to construct and no special equipment is needed to dig the pit.
- ❖ The pit has a longer life than borehole latrine because of greater capacity.

Water seal latrine

Two types

- ❖ The PRAI type evolved by Planning, Research and Action Institute, Lucknow
- ❖ The RCA type designed by the Research cum action projects in Environmental sanitation of the Ministry of Health.

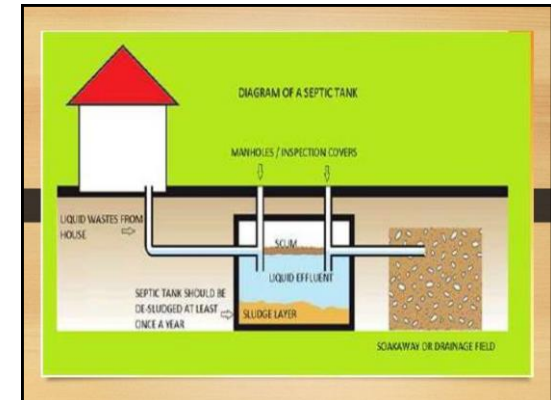
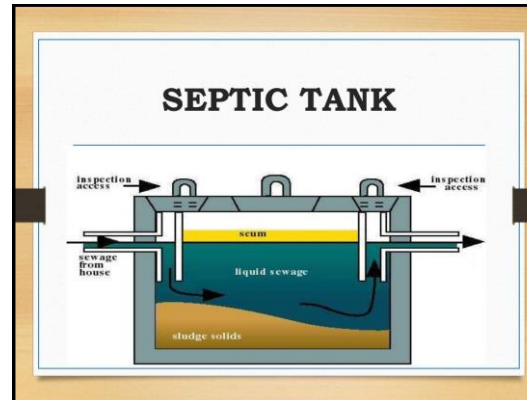
Essential Features of RCA latrine



DESIGN OF RCA LATRINES

- 1. **Squatting plate:** 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
- 2. **Pan:** 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.

3. **Trap:** 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



Features of a septic tank

Capacity	The minimum capacity of a septic tank should be at least 500 gallons
Length	The length is usually twice the breadth.
Depth	The depth of a septic tank is from 1.5 to 2m.
Liquid depth	The recommended liquid depth is only 1.2m.

Features of a septic tank

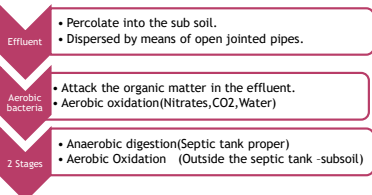
Air space	A minimum air space of 30cm between the level of liquid in the tank and the undersurface of the cover.
Bottom	The bottom is sloping towards the inlet end.
Inlet and outlet	There is an inlet and outlet which is submerged.
Cover	The septic tank is covered by a concrete slab of suitable thickness and provided with a manhole.
Retention period	Septic tanks are designed to allow a retention period of 24 hours.

WORKING OF A SEPTIC TANK

- ⦿ The solids settle down in a tank to form “**sludge**” while the lighter solids like grease and fat rise to the surface to form “**scum**”
- ⦿ **Anaerobic digestion:** Solids are attacked by anaerobic bacteria and broken down into simple compounds.
- ⦿ A portion of the solids is transferred into liquids and gases (methane) which rises to the surface in the form of bubbles.

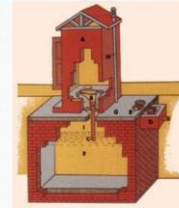
WORKING OF A SEPTIC TANK

- **Effluent:** Liquid which passes out of the outlet pipe from time to time. Contains **bacteria, cysts, helminthic ova, organic matter.**



Aqua privy

- ❖ It consists of a water tight chamber filled with water
- ❖ A short length of a drop pipe from the latrine floor dips into the water.



Aquaprivy

Advantages:

- ❖ Cannot be blocked with bulky anal cleaning material
- ❖ Nil problem with odor or flies
- ❖ Can be connected to a sewerage system at a later date

Aquaprivy

Disadvantages:

- ❖ Expensive to build
- ❖ Need large volumes of water to work
- ❖ Water seal may be hard to maintain
- ❖ Tanks must be emptied about every 3 years

SULAB SHAUCHALAYA

- ❖ The invention of a Patna based firm
- ❖ It consists of specially designed pan and a water seal trap.
- ❖ It is connected to a pit 3 feet square and as deep.



LATRINES SUITABLE FOR TEMPORARY USE AND CAMPS

Shallow trench latrine

- ❖ The trench is 30cm wide and 90-150cm deep.
- ❖ Its length depend on the number of users; 3-3.5 m for 100 people.



LATRINES SUITABLE FOR TEMPORARY USE AND CAMPS

Deep trench latrine

- ❖ The trench is 90 cm wide and 1.8 – 2.5m deep.



Sewage

Sewage

- ❖ Sewage is **waste water** from a community containing solid and liquid excreta .
- ❖ The **average amount of sewage** which flows through the sewerage system in **24 hours** is called the **dry weather flow**.

Health Aspect

- ❖ Creation of nuisance, unsightliness and pleasant odours.
- ❖ Breeding of flies and mosquitoes
- ❖ Pollution of soil and water supplies.
- ❖ Contamination of food
- ❖ Increased incidence of disease

Aim of sewage purification

- ❖ To stabilize the organic matter so that it can be disposed off safely.
- ❖ To convert the sewage water into an effluent of an acceptable standard of purity which can be disposed off into land, rivers or sea.

Strength of sewage

- Biochemical oxygen demand (BOD)
- Chemical oxygen demand(COD)
- Suspended solids

Biochemical oxygen demand (BOD)

- It is defined as the amount of oxygen absorbed by a sample of sewage during a specified period, generally 5 days at a specified temperature generally 20 deg C for the aerobic destruction or use of organic matter by living organisms.
- BOD value range from about 1mg per litre for natural waters to about 300mg/L for untreated domestic sewage.
- If the BOD is 300mg /L and the above , sewage is said to be strong, if it is 100mg/L, it is said to be weak.

Chemical oxygen demand(COD)

- The COD test measures the oxygen equivalent of that portion of the organic matter in a sample which is susceptible to oxidation by a strong chemical oxidizer.

Suspended solids

- The amount of suspended solids in domestic sewage may vary from 100 to 500 ppm.
- If the amount of suspended solids is 100mg/L, the sewage is said to be weak.
- If the amount is 500mg/L the sewage is said to be strong.

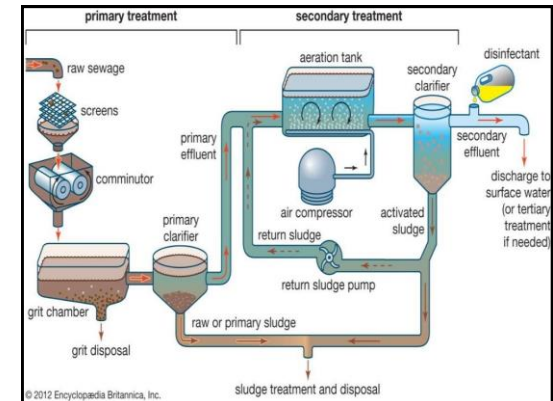
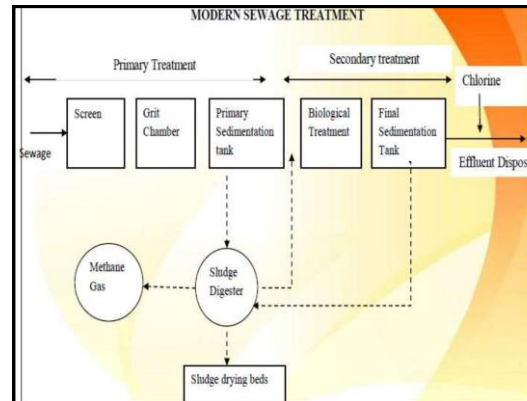
Sewered areas

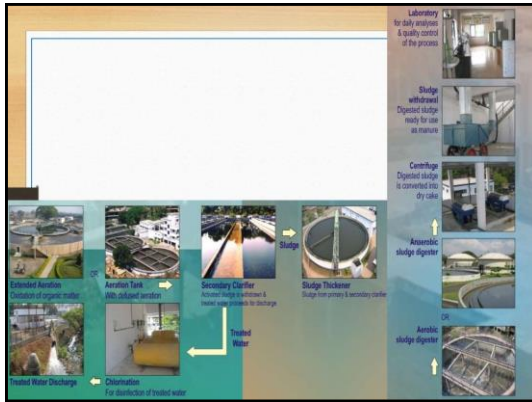


- Screening
- Removal of grit
- Plain sedimentation

- Trickling of filters
- Activated sludge process

- Sea out fall
- River outfall
- Sewage farming
- Oxidation ponds





Primary treatment

- Screening**
 The screen consists of vertical or inclined steel bars usually set 5cm apart.

Primary treatment

- Grit chamber**
 • This chamber is approximately 10 to 20 m in length,
 • it is so designed as to maintain a constant velocity of about 1 foot per second with a detention period of 30 seconds to 1mt.

Primary treatment

- Primary sedimentation**
 • It is a very large tank holding from 1/4 to 1/3 the dry weather flow.
 • Flow very slowly across the tank at a velocity of 1 to 2 feet per minute.
 • The sewage spends about 6 to 8 hours in the tank.

Secondary treatment

Trickling filter method

Activated sludge process

The trickling filter

- The trickling filter or percolating filter is a bed of crushed stones or cinker, 1 to 2 m deep and 2 to 30 m in diameter depending on the size of the population.

Activated sludge process

- The effluent is mixed with sludge drawn from the final settling tank.
- The mixture is subjected to aeration chamber for about 6 to 8 hours.
- The aeration is accomplished either by mechanical agitation or by forcing compressed air continuously from the bottom of the aeration tank.
- Organic matter of the sewage gets oxidized into carbon dioxide, nitrates, and water with the help of aerobic bacteria.

Secondary sedimentation

- Detained for 2-3 hours.
- The sludge that collects in the secondary sedimentation tank is called aerated sludge.
- Part of the activated sludge is pumped back into the aeration tanks in the activated sludge process and the rest pumped into the sludge digestion tanks for treatment and disposal.

Sludge digestion

- *Digestion*
- *Sea disposal*
- *Land*

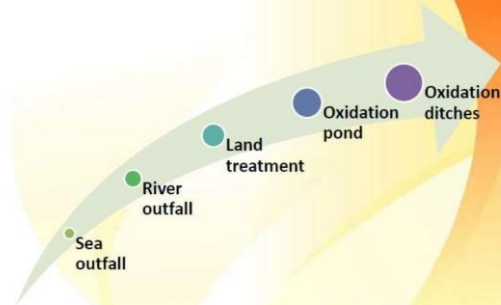
Disposal of effluent

Disposal by dilution

- Diluted in the body of water and impurities are oxidized by the dissolved oxygen in the water.
- The Royal Commission in England (1908) recommended that an effluent from a sewage treatment plant should not have more than 30mg/litre of suspended solids and the 5 day BOD of the effluent including the suspended matter should not exceed 20mg/litre.

Disposal on land

OTHER METHODS



Sea outfall



River outfall

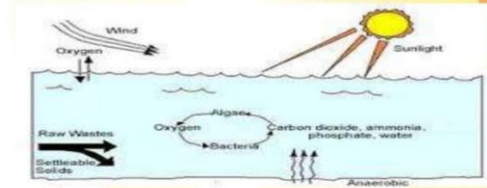


Land treatment (sewage farming)



Oxidation pond

- Open shallow pool 1 to 1.5m depth with an inlet and outlet.
- comprise algae, certain type of bacteria which feed in decaying organic matter and sunlight



Oxidation ditches



Sludge treatment Process

- ❖ Sewage sludge is a **byproduct of treated wastewater**.
- ❖ It is composed of both **organic and inorganic materials**, a large concentration of plant nutrients, organic chemicals, as well as pathogens.
- ❖ Therefore, it is extremely important to properly treat such sludge in order to minimize its environmental repercussions.

Sludge treatment Process



Digestion

- Incubated under favorable conditions of temperature and pH
- Undergoes anaerobic auto digestion
- Complex solids are broken down into water, carbon dioxide, methane and ammonia
- The volume of sludge is also considerably reduced.
- Dry readily and form an excellent manure.

3-4 weeks or longer

