

# Excreta Disposal

Facilitator:

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# Specific Learning Objectives

- At the end of session, the learner shall be able to know about:
  - Importance of human excreta disposal
  - Various methods of human excreta disposal
  - Advantages & constraints of various methods of human excreta disposal.

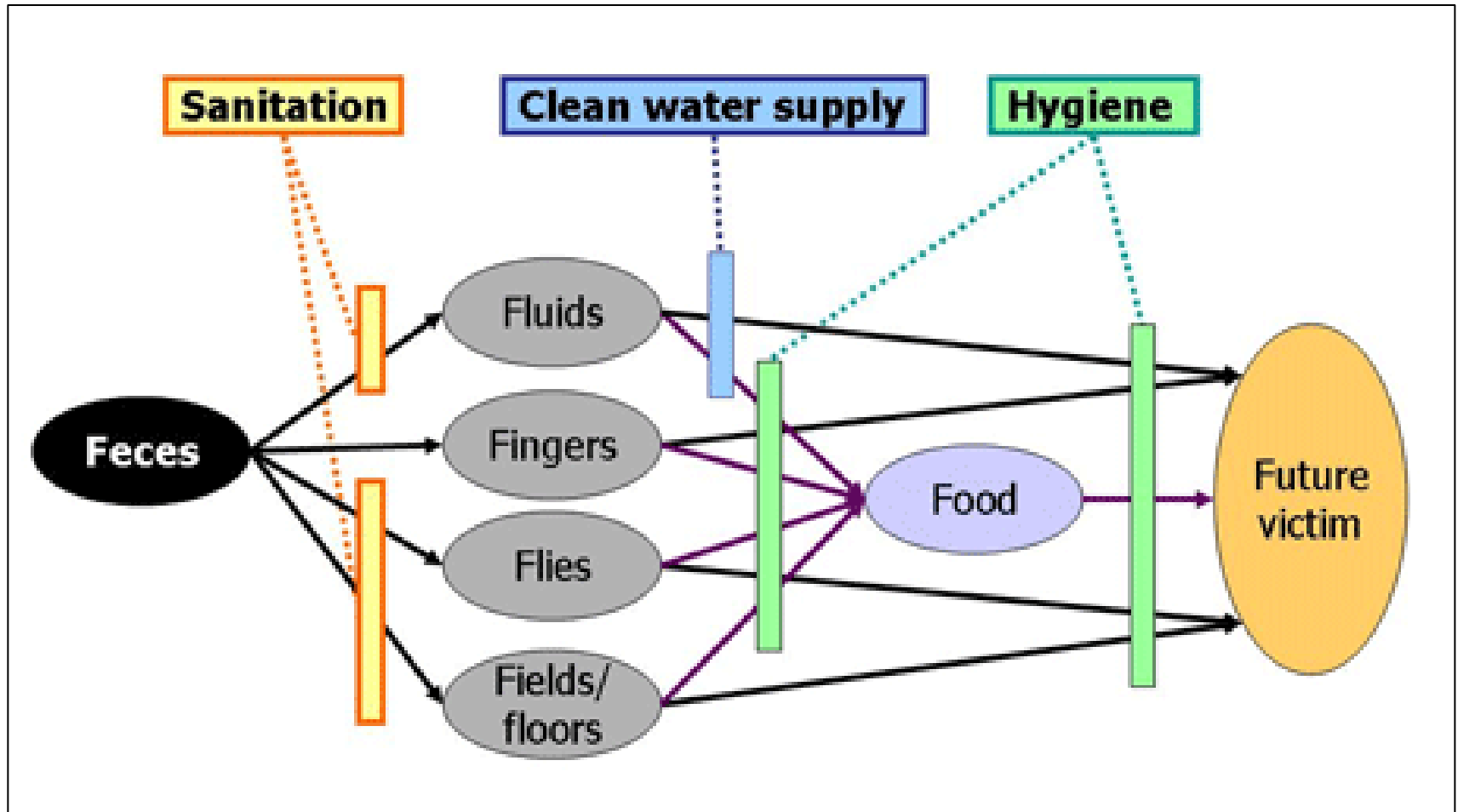
# Introduction

- Human excreta is a source of infection.
- Improper excreta disposal has various health hazards.
  - Soil pollution, water pollution, diseases spread by fecal-oral route
- Disposal of human excreta assumes greater importance.

# In India

- 69% go for open field defecation.
- 21% use improved sanitation facilities
  - ensure hygienic separation of human excreta from human contact
  - e.g. flush/pour flush to piped sewer system or septic tank, Ventilated improved pit latrine, Pit latrine with slab
- 10% use shared and unimproved sanitation facilities.
  - do not ensure hygienic separation of human excreta from human contact
  - e.g. pit latrines without a slab, bucket latrines

# Sanitation Barrier



# Methods of excreta disposal

## I. Unsewered areas

### 1. Service type latrines (Conservancy System)

### 2. Non-service type (Sanitary latrines)

- a) Bore hole latrine
- b) Dug well or Pit latrine
- c) Water-seal type of latrines (PRAI, RCA, Sulabh Shauchalaya)
- d) Septic tank
- e) Aqua privy

### 3. Latrine suitable for camps and temporary use

- a) Shallow trench latrine
- b) Deep trench latrine
- c) Pit latrine
- d) Bore hole latrine

# Methods of excreta disposal

## II. Sewered Areas

### Water carriage system and Sewage Treatment

- a) Primary treatment
- b) Secondary treatment
- c) Other methods (Oxidation pond, sea outfall, river outfall, sewage farming)

# Open field defecation

- Never be accepted as a satisfactory system of excreta disposal
- Might be inevitable in certain circumstances.
  - the only option (**for a displaced population in disaster**) in the initial phase and might work well for 24 to 48 hrs, provided appropriate facilities of open defecation areas are set up.



- In these situations,
  - Clearly demarcated open defecation areas
  - The principles of hygiene must be kept in mind
  - The method must be followed for as short a period as possible.
- The community must be encouraged to use better alternatives.

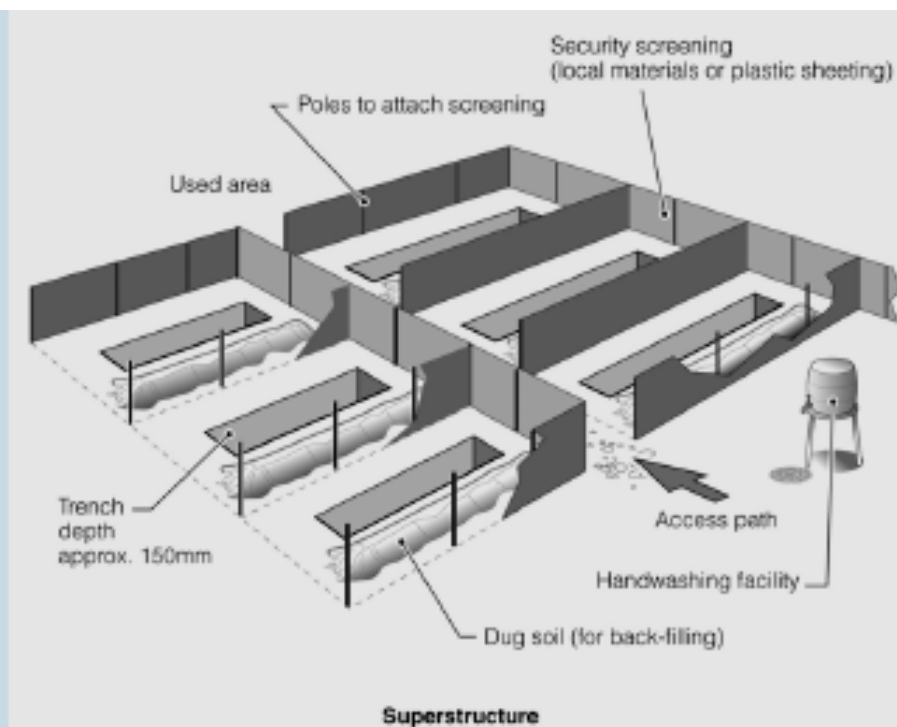
## Service Type Latrines (Conservancy System)

- Night soil is removed by a human agency using a bucket.
- Night soil is **transported in buckets on the head or in night soil carts manually** to a disposal site.
- Disposal may be done through dumping, composting or burial by shallow trenching.

- Totally unacceptable
  - human dignity.
  - hygiene point of view.
- Filthy and insanitary.
- Night soil lying at home awaiting disposal stinks and attracts flies.
- The collection, transport and disposal of night soil, all perpetuate the infection cycle.
- Absence of manpower for this job puts the system to a halt.

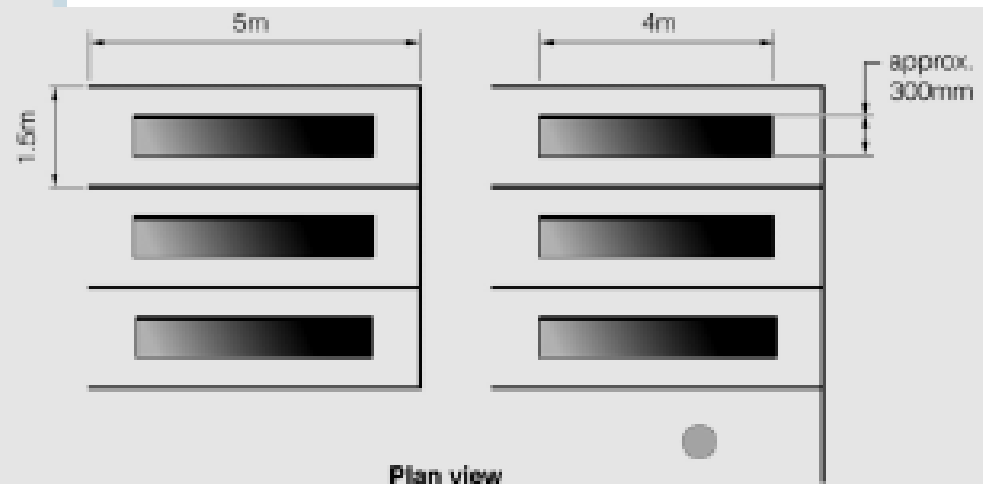
- It was recommended by the Environmental Hygiene Committee, in 1949, that service areas must be replaced by sanitary latrines.
- The **founder of Sulabh International, Dr B Dubey**, also took up the issue in a big way.
  - He showed the way forward by almost revolutionizing the sewage disposal to eliminate human carriage of night soil and installing low cost sanitary latrines instead.

# Shallow Trench Latrines



- 20-30 cm (about a foot) wide
- 15-30 cm (about ½ -1 foot) deep.
- The trench field can be divided into strips 1.5m wide with access paths.
- Dug in parallel with an interval of at least 60 cm in between two trenches.

The earth removed should be neatly piled at its head end which could be used to cover the excreta by each user, and subsequently to fill the trench.



- The issue of privacy is also important. Plastic sheeting, bamboo-mat etc. can be used to make 'walls'.
- The trench is used by squatting astride it, with a foot on either side and not both feet on the same side.
- After defecation the excreta must be covered by earth with a scoop.

# Shallow Trench Latrines

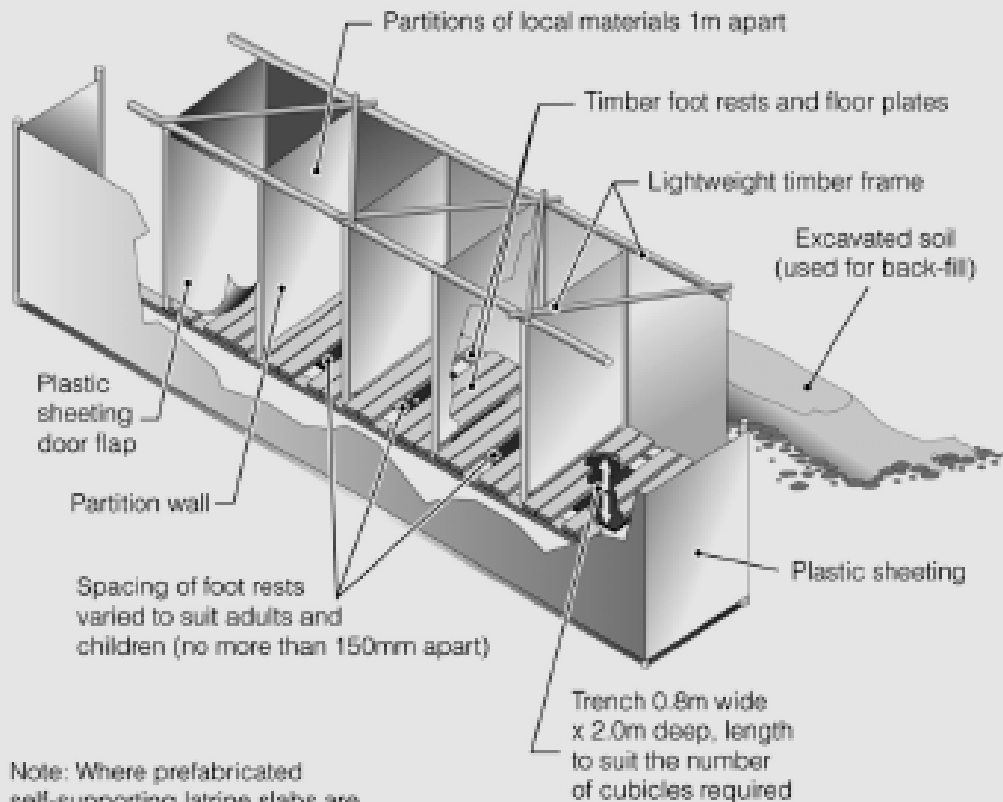
- **Advantages :**

- It is rapid to implement.
- Faeces can be covered easily with soil.

- **Constraints :**

- Limited privacy, short life and requirement of considerable space are some of the constraints.
- Fly breeding occurs if excreta is not covered with earth.

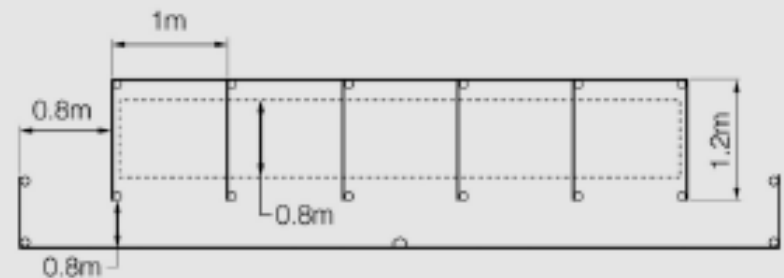
# Deep Trench Latrines



Note: Where prefabricated self-supporting latrine slabs are to be used in place of timber cubicle sizes may need to be adjusted to fit slab width (e.g. 0.8m)

**Superstructure**

- Maximum length of trench is 6m, providing six cubicles.
- 0.8-1 m wide, 3.75 m long and 2-2.75m deep.
- Can be used by 100 people for few months.



**Plan view**



# Deep Trench Latrines

- **Advantages:**

- It is cheap and quick to construct;
- No water is needed for operation.
- It is easily understood by the community.

- **Constraints:**

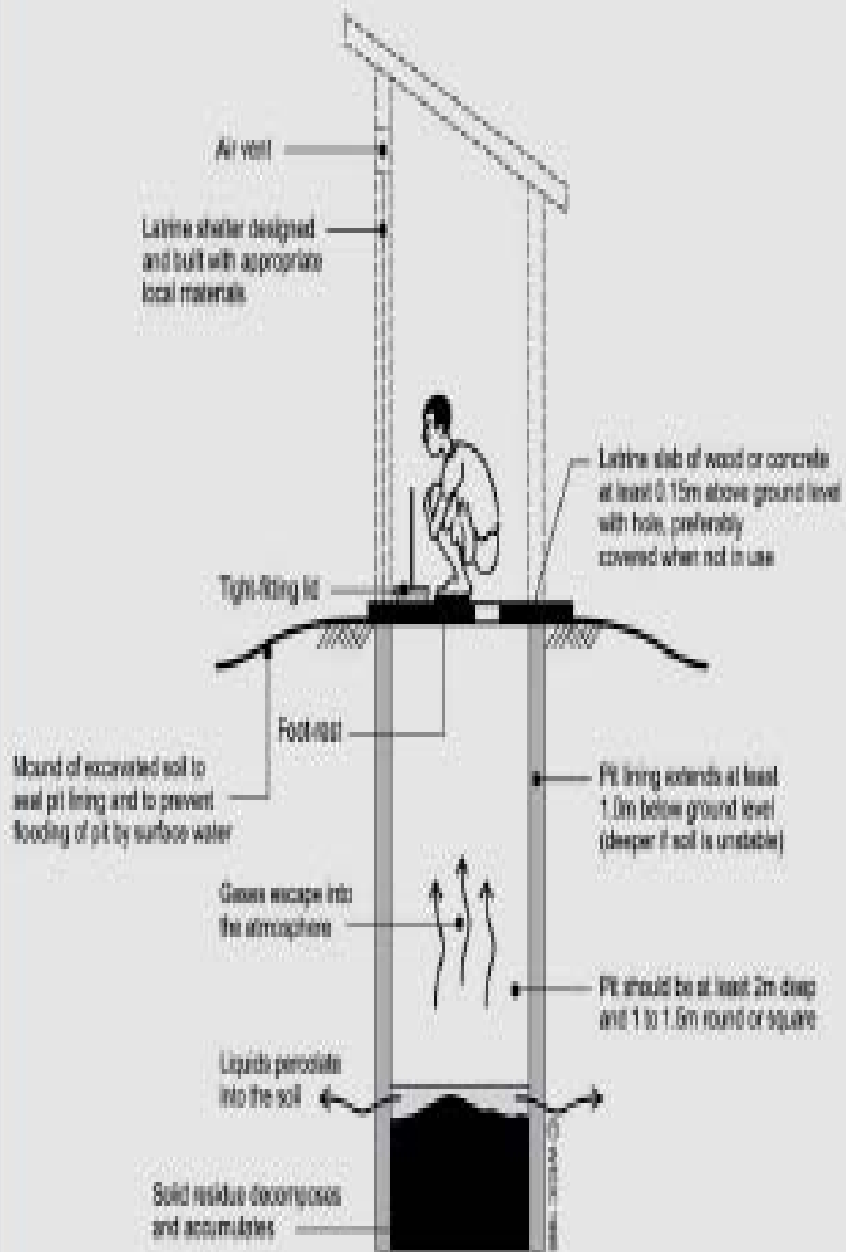
- Unsuitable where water-table is high, soil is too unstable to dig or ground is very rocky;
- Often odour problems;
- Cleaning and maintenance of communal trench latrines are often poorly done by users.

# Improvised Deep Trench Latrine

- An improvisation of Deep Trench Latrine may be carried out **by placing the seats fitted with modified water closets**, 1.5m in front of the long edge of the trench.
- The seats are fitted with a **water seal** (bend pipe) which is connected to a pipe leading into the trench.
- Small quantity of water (2.5 to 3 liters) is sufficient to flush the seats after each use.
- The excreta is flushed through sewage pipes into the trench.

- This type of latrine, therefore, is **more hygienic and acceptable**.
- It is similar in principle to the hand flushed water seal latrine.
- The water seal prevents access to flies by sealing off the night soil and escape of foul gases.

# Simple Pit Latrines (Dug Well Latrine)



- The pit should be as deep as possible (at least 2m in depth)
- Covered by a slab.
- If the soil is loose, at least the top 1m of the pit should be lined to prevent collapse.
- A squat or drop-hole is provided in the slab which allows excreta to fall directly into the pit.
- Firmly supported on all sides and raised above the surrounding ground level to prevent surface water entering the pit.
- The superstructure can be made from materials available locally.

# Simple Pit Latrines (Dug Well Latrine)

- **Advantages:**

- It is cheap;
- Quick to construct;
- No water needed for operation.

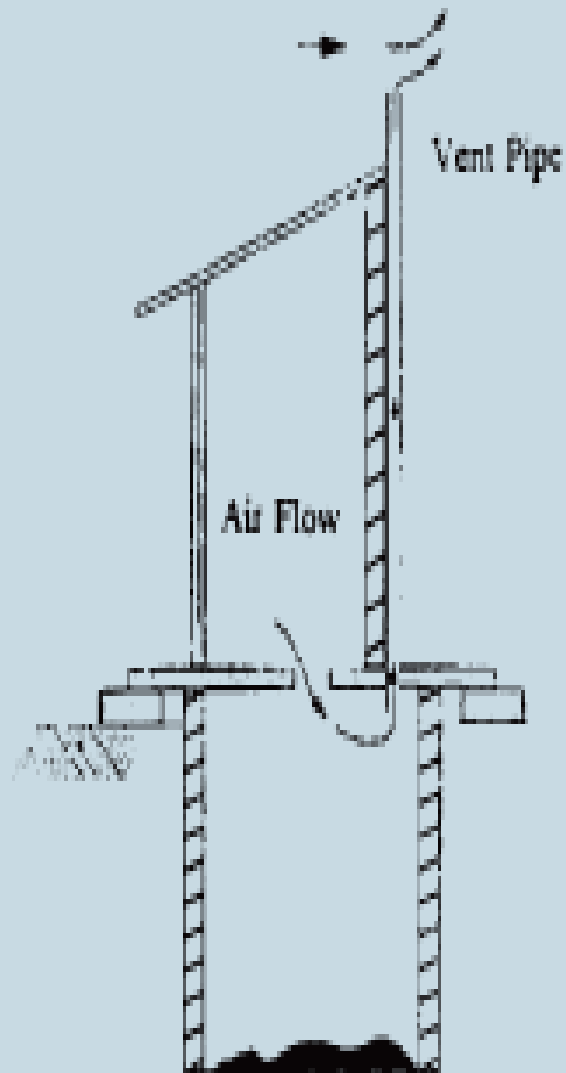
- **Constraints:**

- It is unsuitable where water-table is high, soil is too unstable to dig or ground is very rocky;
- Often odour problems

# Improved Pit Latrine

## V.I.P. (Ventilated Improved Pit)

### Latrine



- This latrine is an improved pit latrine designed **to minimize odour and flies**.
- A vent pipe covered with a gauze mesh or fly proof netting extending at least 0.5m above the superstructure roof is incorporated.
- Air should be able to flow freely through the squat hole and vent pipe; therefore no drop-hole cover is required.
- The superstructure interior is kept reasonably dark to deter flies, but there should be a gap, usually above the door, to allow air to enter

# **Improved Pit Latrine**

## **(The Ventilated Improved Pit Latrine)**

- **Advantages :**

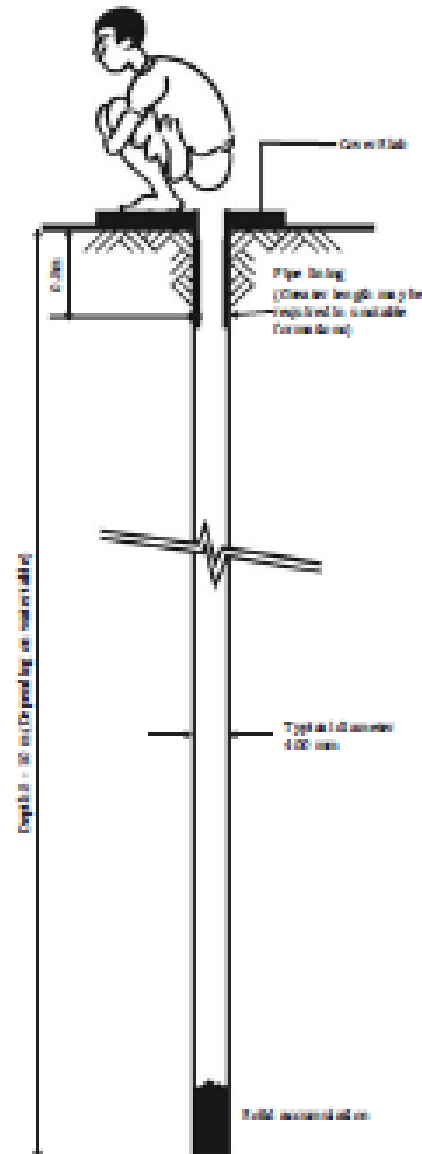
- Reduced odour & flies and good results.

- **Constraints :**

- Difficult and expensive and time consuming to construct properly;

- Dark interior may deter young children from use; does not deter mosquitoes.

# Borehole Latrines



- Borehole latrines are most appropriate in situations **where a large number of latrines must be constructed rapidly**, and where **pits are difficult to excavate**, either because of ground conditions or the lack of a labour force.
- The borehole has a typical diameter of 400mm and a depth of 5-10m. At least the top 0.5m should be lined.
- Last for (a family of) 5 people for 2 years.



# Borehole Latrines

- **Advantages :**

- The borehole can be excavated quickly;
- Suitable in hard ground conditions and appropriate where only a small workforce is available.

- **Constraints :**

- Drilling equipment is required;
- There is a greater risk of groundwater pollution due to greater depth than pit latrines;
- Lifespan is short; sides are liable to be fouled, causing odour and attracting flies; and there is a high likelihood of blockages.
- This option should only be considered in extreme conditions when pit excavation is not possible.

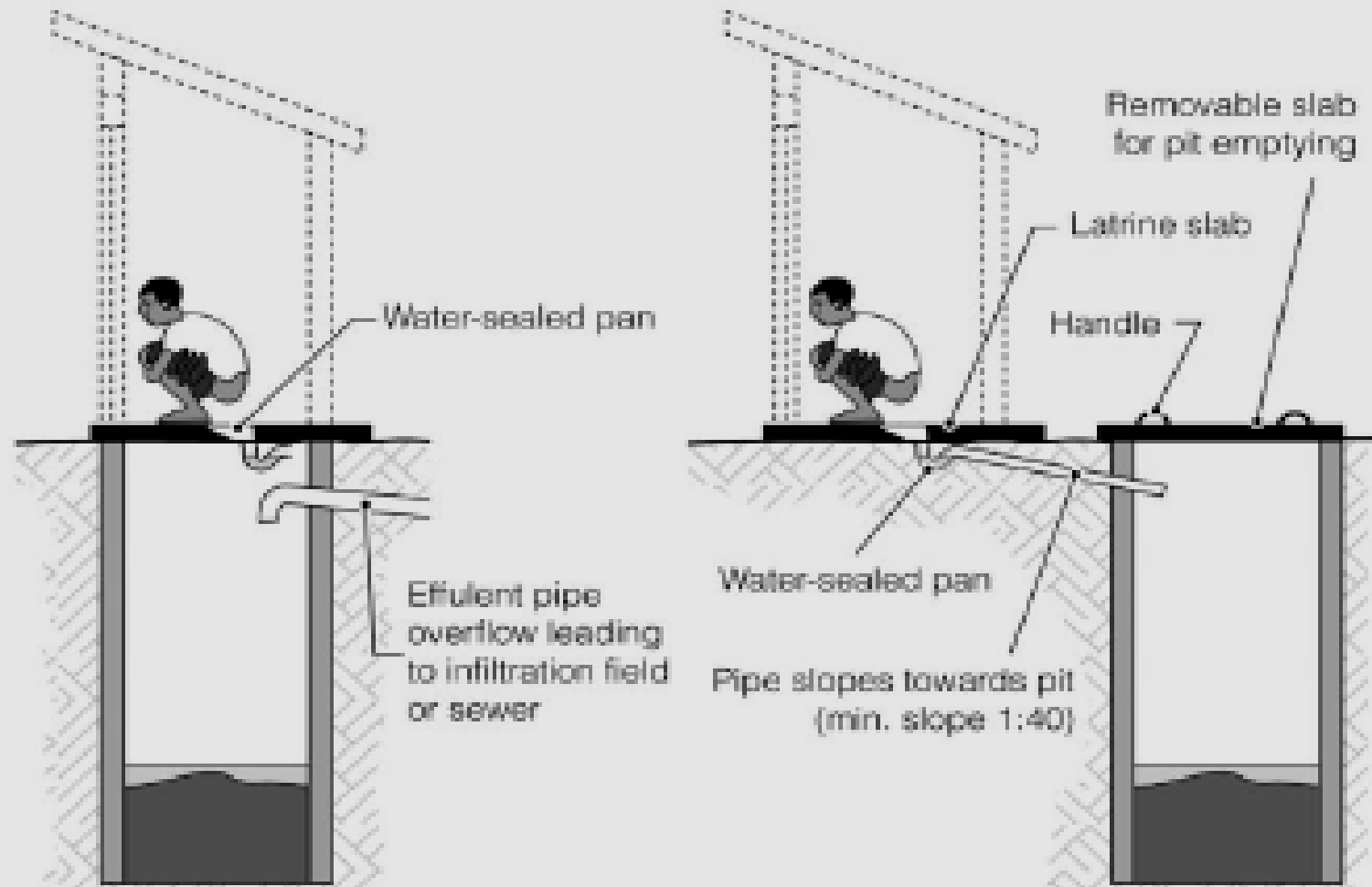
# Pour-Flush Latrines

## (Water Seal Latrines)

- Pour-flush (hand flush or water seal) latrine is a very hygienic mode of excreta disposal.
- It functions on the principle of a **‘water seal’**.
- Water acts as a hygienic seal and helps remove excreta to a wet or dry disposal system.
- The simplest pourflush latrines use a latrine pan incorporating a **shallow U-bend which retains the water (water seal)**.

- After defecation, a few litres of water must be thrown into the bowl in order to flush the excreta into the pit or sewerage system below.
- The amount of water required to flush the system will depend on the type and size of the water-seal construction.
  - 90mm U-bend normally requires 2-3 litres to flush effectively
  - 120mm U-bend generally requires 4-5 litres to flush.
- These quantities are significantly less than the amount required to flush most western water-closet toilets which may use as much as 15 litres per flush.

# Pour-Flush Latrines (Water Seal Latrines)



Pour-flush latrines may be constructed directly above a pit or may be offset whereby the waste travels through a discharge pipe to a pit or septic-tank

# Pour-Flush Latrines (Water Seal Latrines)

- **Advantages :**

- Lack of odour;
- Relatively less water is used up.
  - It is ideal where water is used for anal-cleansing;
- Easy to clean;
- Off-set design does not require a self-supporting latrine slab.

- **Constraints :**

- Solid anal-cleansing materials may cause blockage;
- More expensive than simple pit latrines.

# Variants

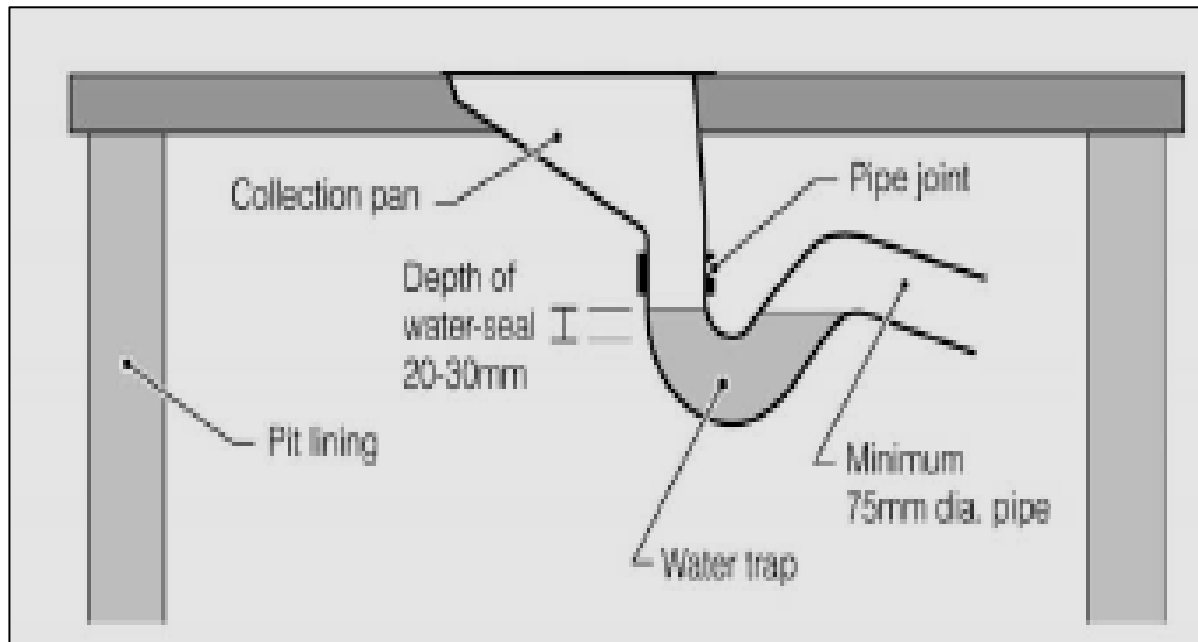
- Several designs have been tried and are in use. Noteworthy of these are those made by:
  - Planning Research and Action Institute (**PRAI**), Lucknow
  - Research cum Action Project (**RCA**), Ministry of Health.
    - The RCA latrine is widely in use.

# *Design of a **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.

# ***RCA Latrine***

- 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.

# Septic Tank

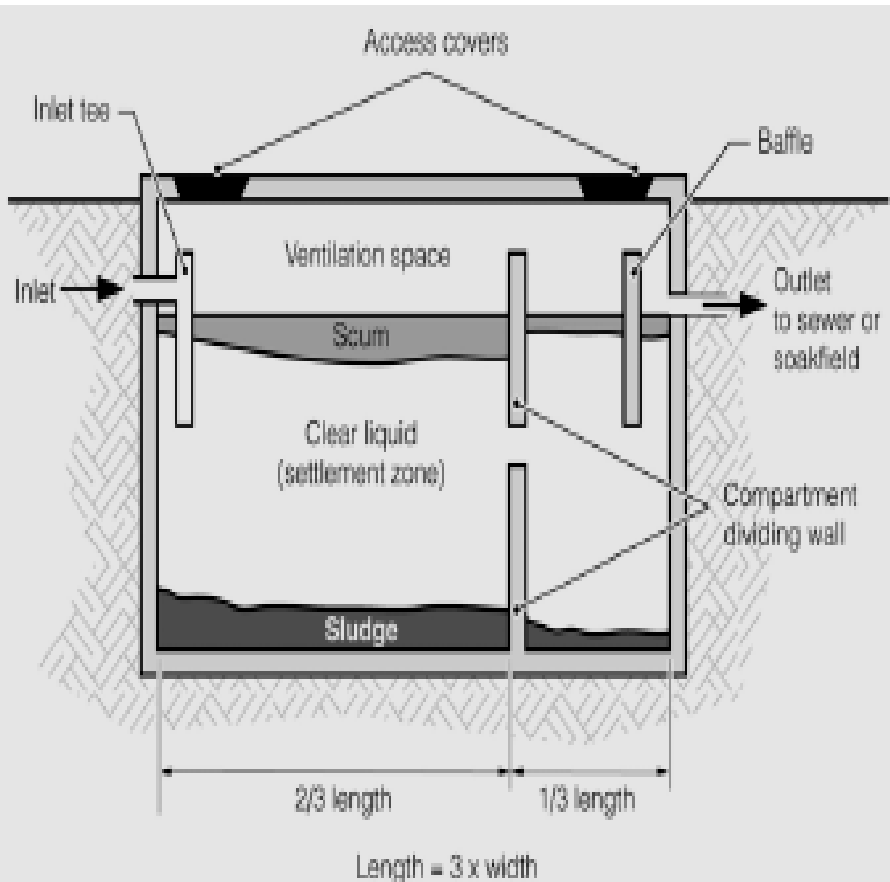
- An ideal system for hygienic final disposal of excreta in the absence of a central sewerage system.
  - Excreta from many pour-flush latrines can be discharged into a septic tank.
- Designed to collect and treat excreta and toilet wastewater.
- Use is likely to be appropriate where
  - the volume of wastewater produced is too large for disposal in pit latrines,
  - water-borne sewerage is uneconomic or unaffordable.

- Particularly suited to systems involving high water use, especially where water is used for flushing and anal-cleansing.
- Difficult to manage for very large populations
- Best suited to single households or a group of households or institutions such as hospitals or schools.
- **The efficiency of a septic tank system is inferior to the sewage works but is much cheaper, quicker and easier to provide and maintain than sewage works.**

# 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: 20-30 gallons per user with a minimum size of 3mx3m (500 gallons).
- 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 (**single vs. double chambered septic tank**).
- 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.

# Maintenance

- The operation and maintenance of a septic tank is simple.
- To commission a septic tank it has to be first filled with water and then seeded with a bucketful of sludge from another tank.
- Not less than 25 liter of water per day per user must enter the tank.
- Use of soap water and chemicals should be avoided.
- Sludge from the tank is to be bailed out once in a year or two.

- Routine inspection is necessary to check whether desludging is needed, and to ensure that there are no blockages at the inlet or outlet.
- A simple rule is to desludge when solids occupy between one-half and two-thirds of the total depth between the water level and bottom of the water tank.



# Communal Aqua-Privies

- An aqua-privy is a latrine constructed directly above a septic tank.
- Aqua-privies are appropriate where pit latrines are unacceptable.
- The amount of water required for flushing is much smaller than for a septic-tank due to the location of the tank.
- It helps to exclude odours from the superstructure.
- Not more than four families per latrine.

- **Advantages :**

- Reduced odour; ideal where water is used for analcleansing; easy to clean.

- **Constraints :**

- Increased quantity of water required; solid analcleansing materials may cause blockages; more expensive and difficult to construct than simple pit latrines.

# Sulabh Shauchalaya

- The concept was introduced by **Dr. B. Dubey**.
- He modified the standard hand flush latrine to suit rural Indian community.
- It consists of a specially designed pan and a water seal trap.
- It is connected to a pit 3x3x3 feet.
- Minimal water is needed in the process.
- The excreta gets decomposed to manure in the pit.
- This provides clean and sanitary toilets to the users at a minimal cost.
- These are also maintained by the Sulabh International society.

# Chemical Toilets

- Chemical toilets are sanitation units that consist of a squatting pan placed above a water-tight excreta-holding tank, which usually contains a chemical solution (formaldehyde, etc) to aid digestion and reduce odour.
- This is contained in a single prefabricated plastic unit with a lockable door.
- These can be adopted as temporary solutions where pit latrines or septic tanks are unsuitable or unacceptable, as in aircrafts or trains.
- The initial charge of chemical is adequate for 40 to 160 uses.

- **Uses :**

- These are used in aircrafts and as a short term measure in disasters, etc.

- **Advantages :**

- Portable; hygienic; minimized odour; can be mobilized rapidly.

- **Constraints :**

- High cost; unsustainable for long periods; regular servicing and emptying required.

# Water carriage system

- Useful for large residential and commercial.
- The human excreta and waste water are carried away by a network of underground pipes called sewers to the ultimate disposal site.
- Used for the first time in Calcutta (in India) in 1867.
- But even today, unfortunately not more than 20 percent of the urban areas in India can boast of this method of sewage disposal.

- Laying down such a system is infrastructure and capital intensive.
- It amounts to digging up lanes and by-lanes.
- Skilled manpower is a must to establish the system.
- Piped water supply is mandatory to run the system.
- On - going maintenance has to be done to keep the pipes going.
- The ideal system of sewage disposal in large cities.

# Classification

- Two types of sewerage systems:
  - The combined system
    - Carries both sewage and storm water in the same sewage line.
  - The separate system.
    - The surface water is not admitted into the sewers.
    - The system of choice.



# Components

- **(a) Household Sanitary Fittings :**
  - These include water closets, urinals, washbasins, bathtubs along with their plumbing systems.
- **(b) Soil Pipes :**
  - These are pipelines, which carry excreta from the water closets to the house drain.
  - They are fitted with outlet ventilators for the escape of foul gases and hence are placed outside along rear walls of the houses and are carried above the roof tops.

- **(c) House Drains :**

- It is an underground iron or stoneware pipe usually of 10 cm diameter and is laid in the courtyard 15 cm below the ground level on a bed of cement concrete mix with sufficient gradient towards the public sewer.
- It carries away the discharges from the household sanitary fittings to the street sewers.

- **(d) Public Sewer :**

- It is a network of underground pipelines varying in diameter from 22 cm to 3 m for carriage of sewage from domestic, industrial and commercial areas to the place of final disposal.
- While laying the pipelines sufficient gradient is to be ensured for self-cleansing velocity of sewage.
- This velocity varies from 60 cm to 90 cm per second.

- **(e) Sewer Appurtenances :**

- **(i) Manholes :**

- Manholes are the openings built in sewers for the purposes of repairs and cleaning.
- They are placed wherever there is change in the direction of sewers, at the junction of two or more sewers and at a distance of 100 meters in the long, straight run of the sewers.
- Workers entering manholes are at a risk of gas poisoning and asphyxiation; so due precautions must be taken while entering them.

- **(ii) Traps :**

- Traps are devices designed to prevent entry of foul gases inside the house and to remove sand, grit, grease etc. from sewage.
- Traps are placed at three points (1) under the water closet, (2) at the junction of the house drain and the street sewer and (3) where the surface water enters the sewers.

# Green toilets

- Research Design and Standards Organisation (RDSO)
- A *green toilet* may be defined as the toilet system, which discharges effluent according to the environmental norms.
- The system is also known as '**environment friendly toilet system**' (EFTS).
- The green toilets aim at zero-defecation on the ground.
- This will improve level of cleanliness at stations, reduce corrosion of rails and rail fittings and consumption of water.
- This will ensure better cleanliness and hygiene of coaches.

- Indian railways is in the process of developing two types of the EFTS:

➤ **The Bio-toilet system:**

- human waste is converted into liquid and gases.
- The gases get mixed with air and liquid is discharged on the track.

➤ **The Zero-discharge system:**

- solid and liquid waste is separated using special type of solid-liquid separator, the liquid is recycled after proper treatment and waste is converted into manure.

# Match the following

Population group with most suitable method of sewage disposal

1. Joint family in a village

(a) Trench latrine

2. Large city

(b) Septic tank

3. Group of 20 households

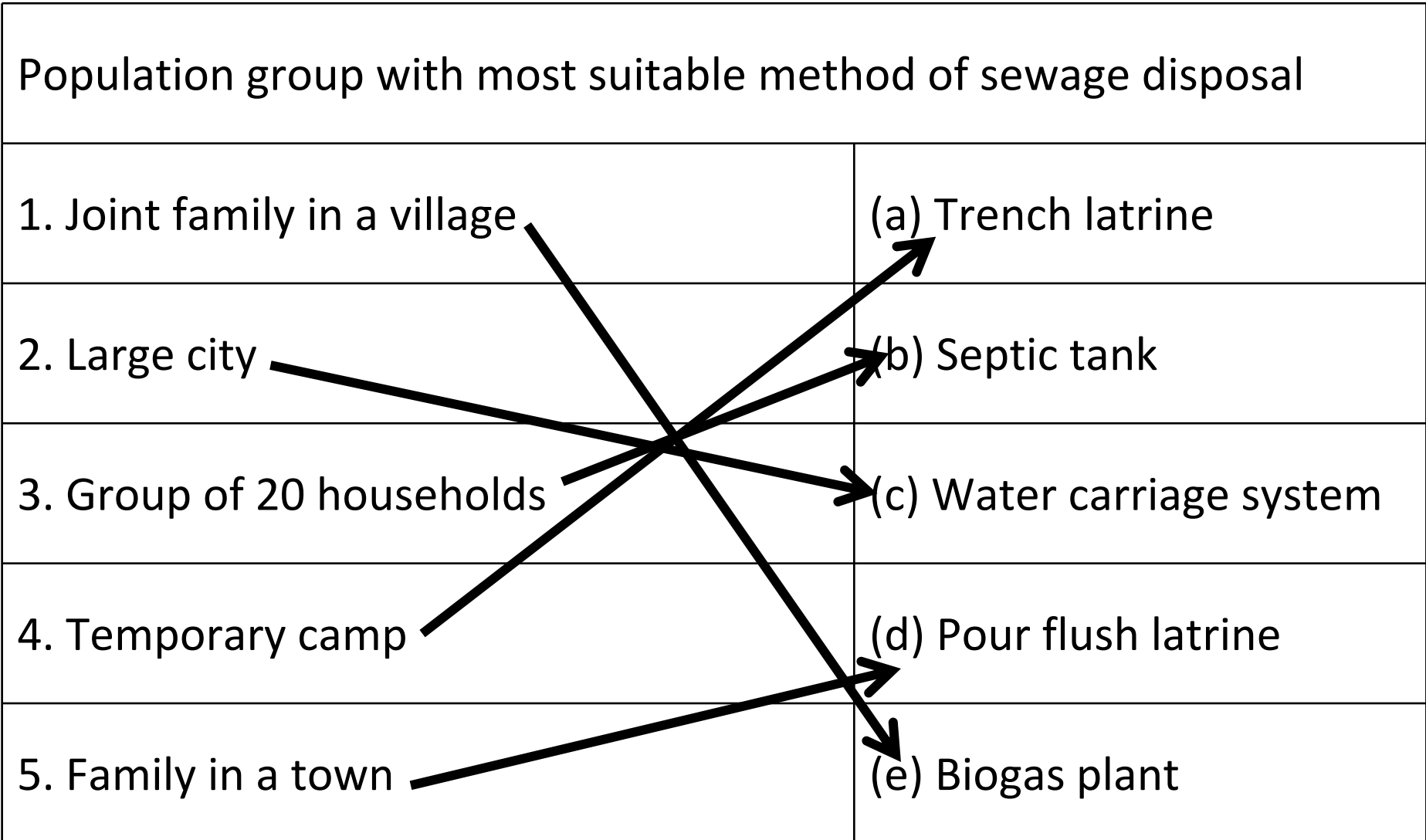
(c) Water carriage system

4. Temporary camp

(d) Pour flush latrine

5. Family in a town

(e) Biogas plant



# Take Home Message

- Effective and hygienic disposal of excreta is a social need as well as health need.
- Open defecation might still be a preferred method in many rural areas.
- In the areas without sewage system, simple pit latrines and bore hole can be used but the pour flush latrine is the ideal one.
- Trench latrines can be used for camps for short durations.
- Septic tank is a suitable method of final disposal of night soil.
- Water carriage system is the ideal system of sewage disposal.