PURIFICATION OF WATER AND SANITATION

Access to safe water for many of the rural populace and the urban poor is still a mirage. Pollution of both surface and ground water sources has led to a sharp decline in the quality of water which by itself is a diminishing commodity.

Disasters, whether natural or man made, first affect the quality of water due to influx of population, pressure on an already vulnerable distributive system, pollution of water sources by debris and carcasses leading to resultant health hazards.

Purification techniques for day-to-day use and during disasters are discussed in detail. Pot and well chlorination, 3-pot filters, chlorination during disasters and the importance of environmental sanitation are some of the major aspects of water purification illustrated in the following pages.

SOURCES

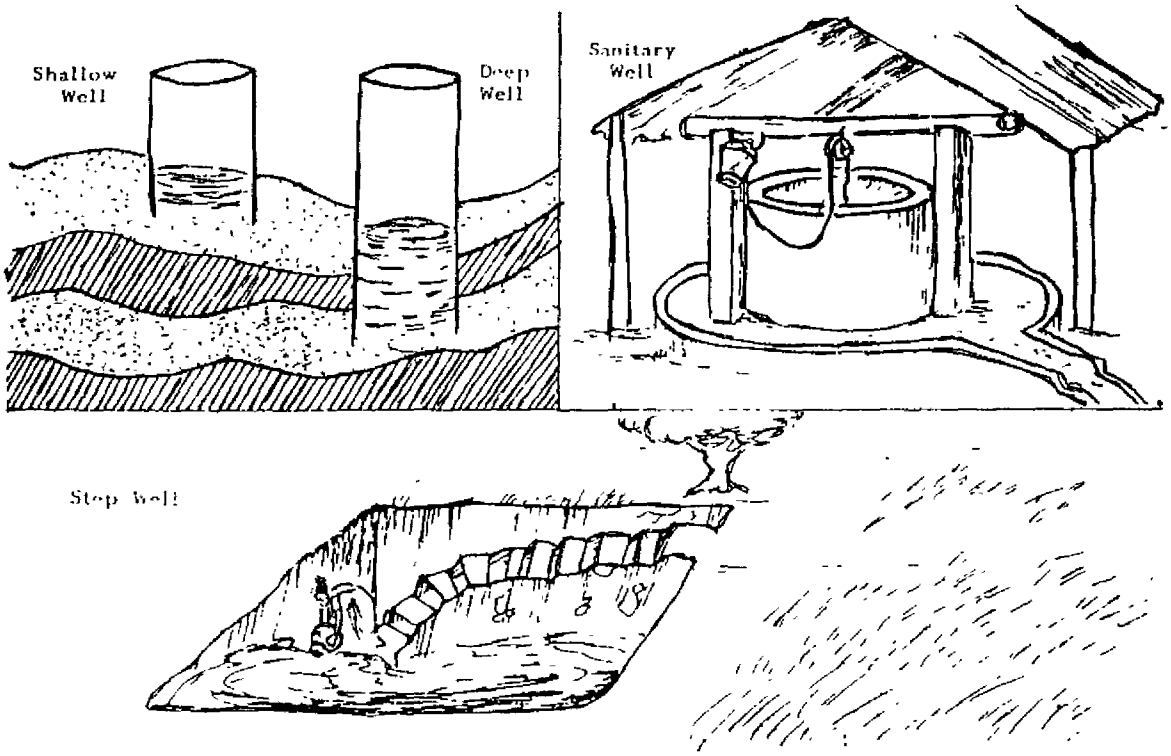
1. Rain water

2. Surface water

- Reservoir
- River
- Tanks

3. Ground water

- Shallow wells
- Deep Wells
- Pucca Wells
- Kutcha Wells
- Step Wells
- Tube Wells
- Springs



BEST SOURCE OF WATER DEPENDS ON . . .

- Quantity
- Availability
- Quality Of Water (physical, chemical, bacteriological)
- Quantity of water required depends on purpose of use
- Personal use = 150-200 Litres /day/ person

SOURCE	CHARACTERISTIC	IMPURITIES
RAIN	Pure,Sparkling, Soft, Corrosive	Gathers from the Atmosphere-Gases, Dust, Soot
SURFACE WATER a) Impounding Reservoir	Clear, Palatable,Reasonably Pure	Human and Animal Waste from Catchment area
b) Rivers	Grossly polluted not clear	Surface washings, sewage, Industrial waste, Trade Waste,Pesticides
c) Tanks	Grossly Polluted, can be improved by -- Fencing, Cleaning, Elevating Edges, Digging Tube Wells.	Surface Washings, Sewage, Industrial Waste, Trade Wastes,Pesticides
GROUND WATER,	Pure, Cheap Supply even, Requires lifting of water	High mineral content
a) Sanitary Well	Covered platform, Drain 50m from contamination, lined for first 20m, Hand Pump	
b) Kutcha Well	Un lined	From Surroundings seep into the well
c) Step Well	Polluted, Spreads Guinea Worms	From Consumers stepping in to the well
d)Tube Wells	Clean Water, Needs hand pumps and maintenance, even supply	From water used for priming
e) Springs	Quality and quantity not dependable	

Physical Qualities

- Clarity - Helps in assessment of contamination and in purification.
- Colour - Water should be colourless
- Smell - acceptable to the consumer
- Taste - not a disagreeable taste

REMEMBER . . . . . .

Sweet And Clear Water Is Not Always Safe.

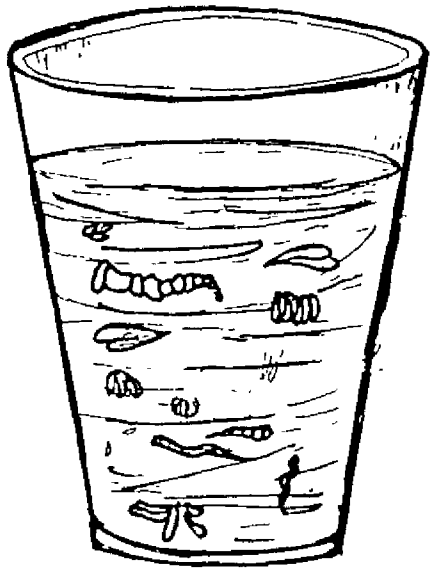
Biological Qualities

- Absence of larvae, parasitic worms and eggs, bacteria such as E-coli, viruses such as polio etc

Chemical Qualities.

- Metals such as Arsenic, Cyanide, Lead, Iron, Chloride and Nitrities etc.
- Presence of some of these show contamination by human faeces .

What a glass of water could contain...



CLASSIFICATION OF POLLUTANTS

- Physical pollutants :- Colouring agents mud, radioactive rays, Leaves
- Chemical pollutants :- Iron, flouride etc.
- Bacterial,viral pollutants E.- coli, polio virus etc.

May be

Dissolved	gases, colouring matter
Suspended	Leaves. Clay, Silt,, Plants, Worms Etc.

WATER POLLUTION

Means of pollution

- Indiscriminate defaecation
- Agricultural irrigation - pesticides, fertilisers and dead leaves.
- Household and street refuse.
- Industrial/trade waste.
- Radioactive substances.

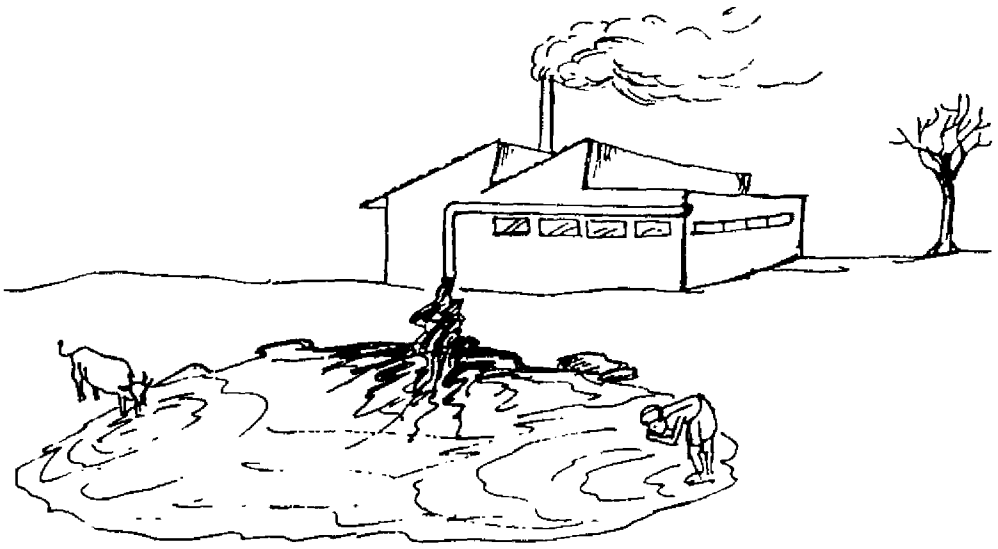
Man is affected by. . . . . .

Drinking, cleaning himself, swimming, eating foods grown in such water.

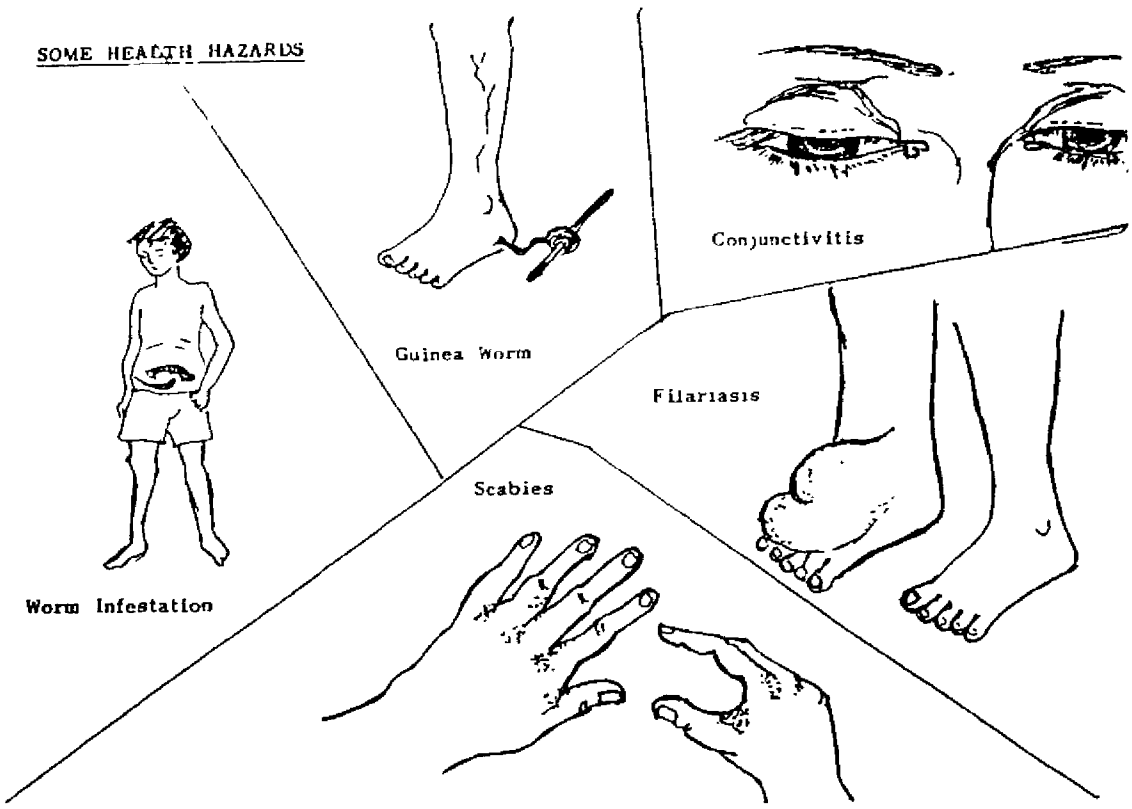
CHEMICAL POLLUTANTS

Contamination Through Chemicals Leads To :

Immediate	:	Death, abdominal pain etc.
Slow	:	The body organs are affected. Eg: Mottling of teeth , Blood production, skin problems



BIOLOGICAL POLLUTANTS

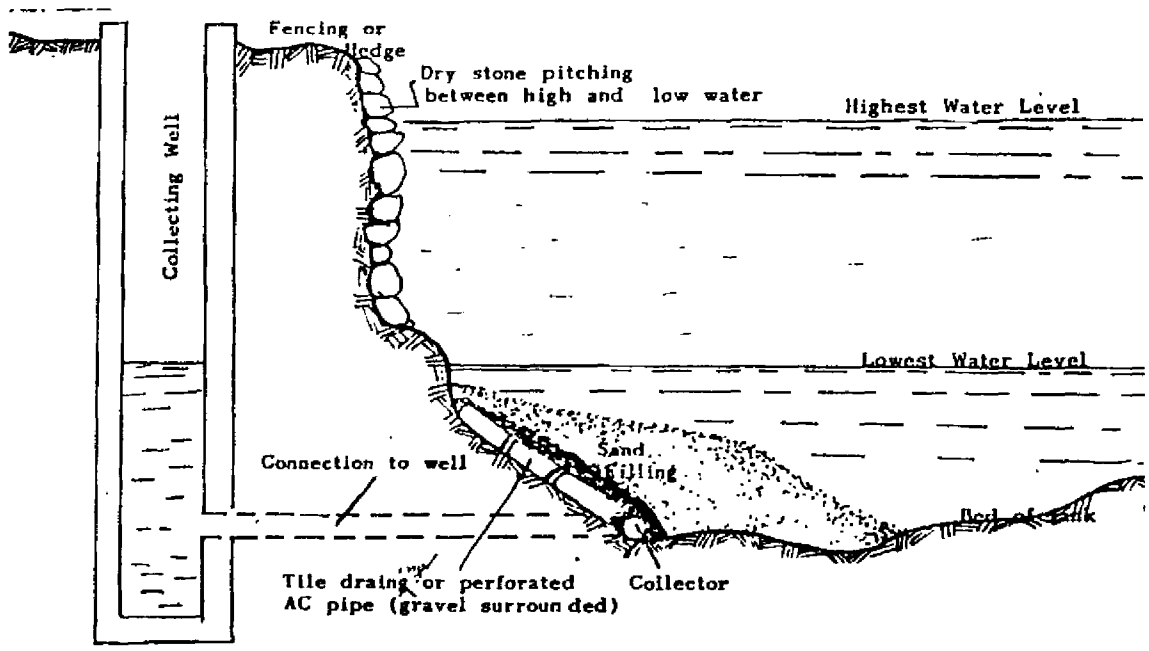


- **Water Borne Diseases** - Infective agent is carried in water. Eg. Cholera, Worms, typhoid, hepatitis.
- ***Water Washed Diseases*** - Use of water for personal cleaning. Eg. Eye infection, Scabies, Fungus.
- **Water Related Diseases** - Water serves as a medium in which vector breeds.
- **Water Based Diseases** - Diseases carrying insectors live

  Eg. Snail, cyclops.

MAINTENANCE OF WATER SOURCES

MAINTENANCE OF TANKS



Wells

- Dry the wells once a year.
- Scrape and wash wells.
- Give a coating with milk of lime and allow it to dry.
- Allow for water to fill up.
- Chlorinate every 2 weeks.
- Some fish could be grown to kill harmful organisms.

Ponds/Tanks

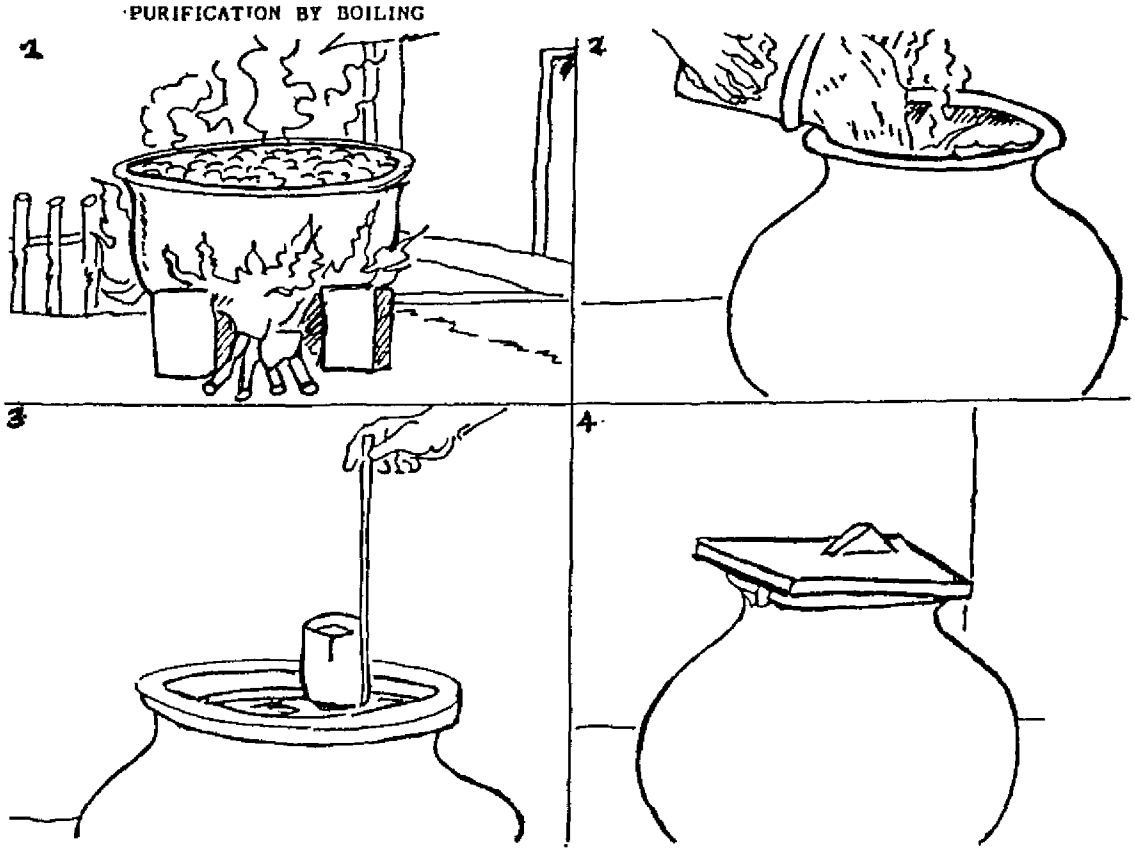
- Bar entry directly into tank.
- Erect an elevated platform for drawing water.
- Elevate the tank edges to prevent entry of surface water.
- Provide fencing to prevent animals.
- Chlorination is necessary whenever possible.
- Clean the tank at the end of dry season.

WATER PURIFICATION

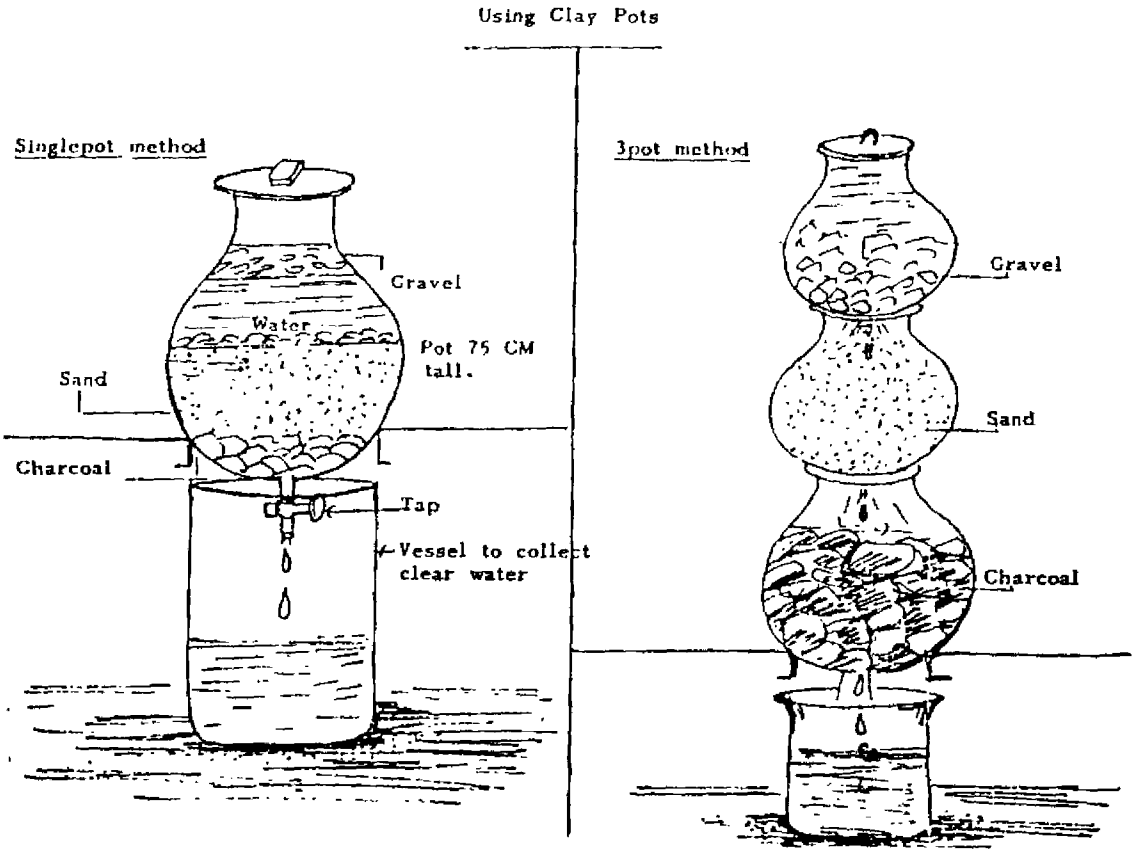
- Boiling
- Chlorination
- Filtration
- Storage

Boiling

- Bring the water to rolling boil and keep it boiling for 10 minutes.
- Store in a clean vessel.
- Same container to be used by all to remove water.
- Keep the mouth of container closed.



Filtration



- The water is made to pass through sand, gravel or charcoal Bacteria and other pollutants are removed.

Storage

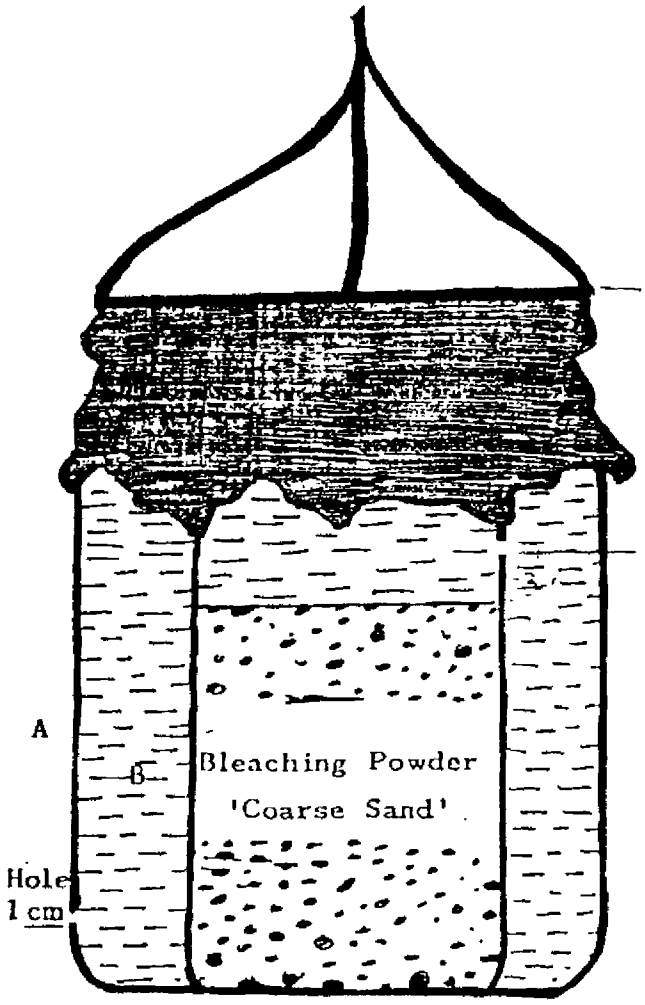
- Simplest
- 90% organisms die within 5 to 7 days
- Dead matter become harmless
- solids settle at the bottom
- Addition of Aluminium Sulphate (Alum) 80 GM/100 Litres helps to settle the solids.

Chlorination
(using Bleaching Powder)

RULE . . . . . .

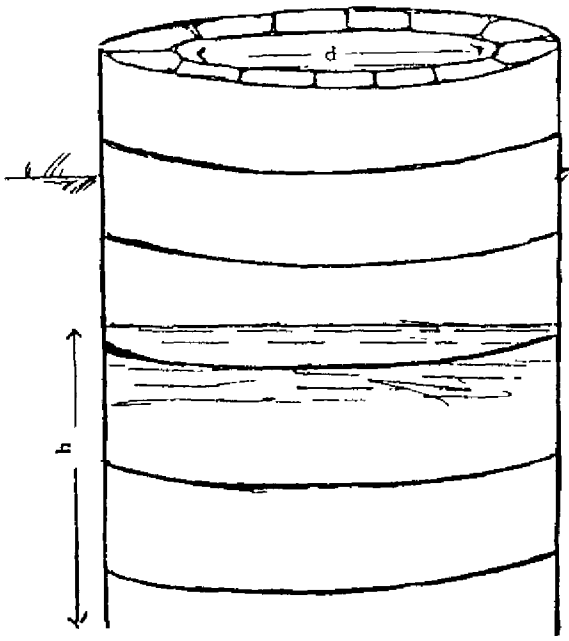
- Water should be clear.
- Usual dose is 2.5 GM per 1000 litres of water unless chlorine demand is known.
- Contact period of 1 hour necessary.
- If water is grossly polluted, use large doses of bleaching powder. Remove excess Chlorine by adding Sodium Sulphate or Sodium Thiosulphate 1 kg/60,000 litres.

Double Pot Method Of chlorination



- Outer pot A has a hole 1cm near the bottom.
- Inner pot B has a hole 1cm near the top and contains bleaching powder - Sand mixture (1:2)
- Mouth is covered tightly with a plastic bag.
- The pots are immersed in water at least 1 metre deep. Utility period is decided by the quality of water being chlorinated.

Chlorination of Wells



d = diametre of well

h = height of water

Volume of Water = $\frac{d^2h \times 1000}{4}$ L

= $785.7d^2h$ L

Bleaching Powder required -

= $\frac{2.5 \times 785.7d^2h}{1000}$

= $1.96\ d^2h$ gm

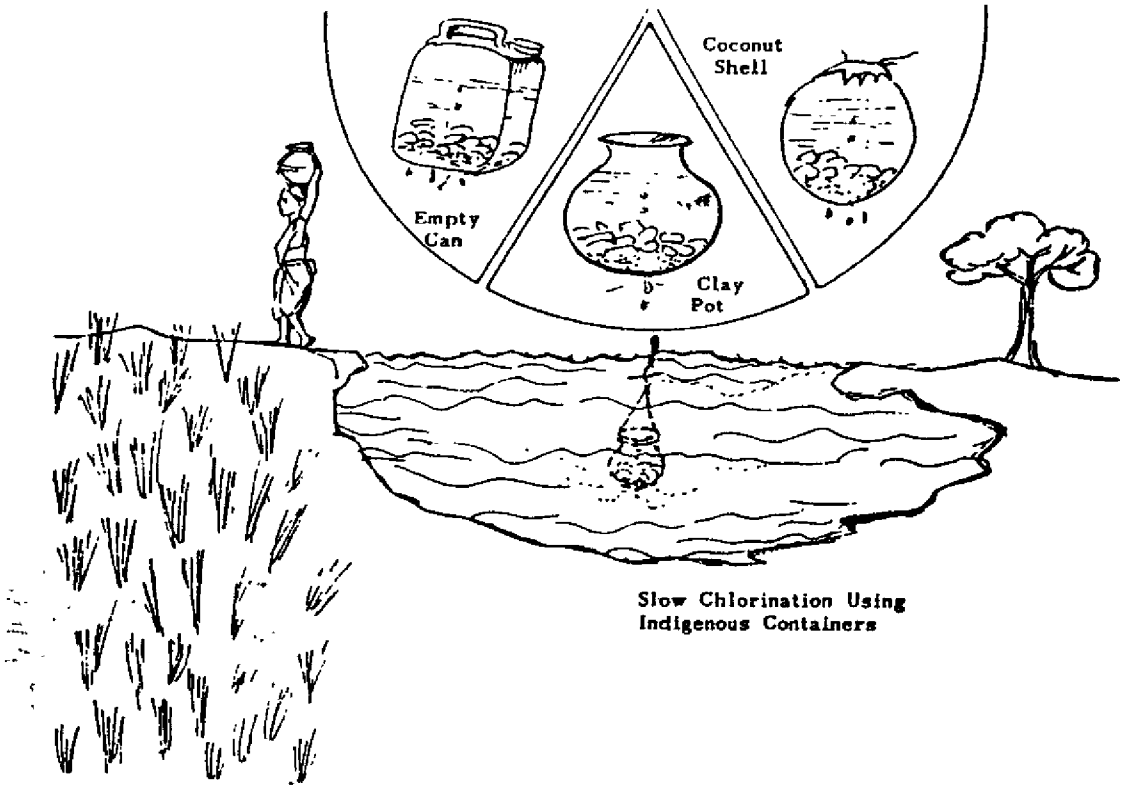
Steps Of Chlorination During Epidemics

- Tie a stone to a long rope and drop it into the well.
- Measure the length of rope which is wet. This gives us the height of water - h metres.
- Measure the difference across the mouth of the well i.e. its diameter - d metres.
- Find out the quantity of bleaching powder needed.
- Make a paste of that powder in water. Add more water to 3/4 bucket and allow it to settle.
- pour the clear fluid into another bucket and lower it into the well, shake it up and down mixing it with well water.
- Allow one hour before using the water.

Ring Size	Volume of Water (litres)	Bleaching Powder Needed
4' x 1 1/2'	509	1/4 teaspoonful
4'x 1/2'x 1'	429	1/5 teaspoonful

Slow Chlorination

Use bleaching powder and sand (1:2).



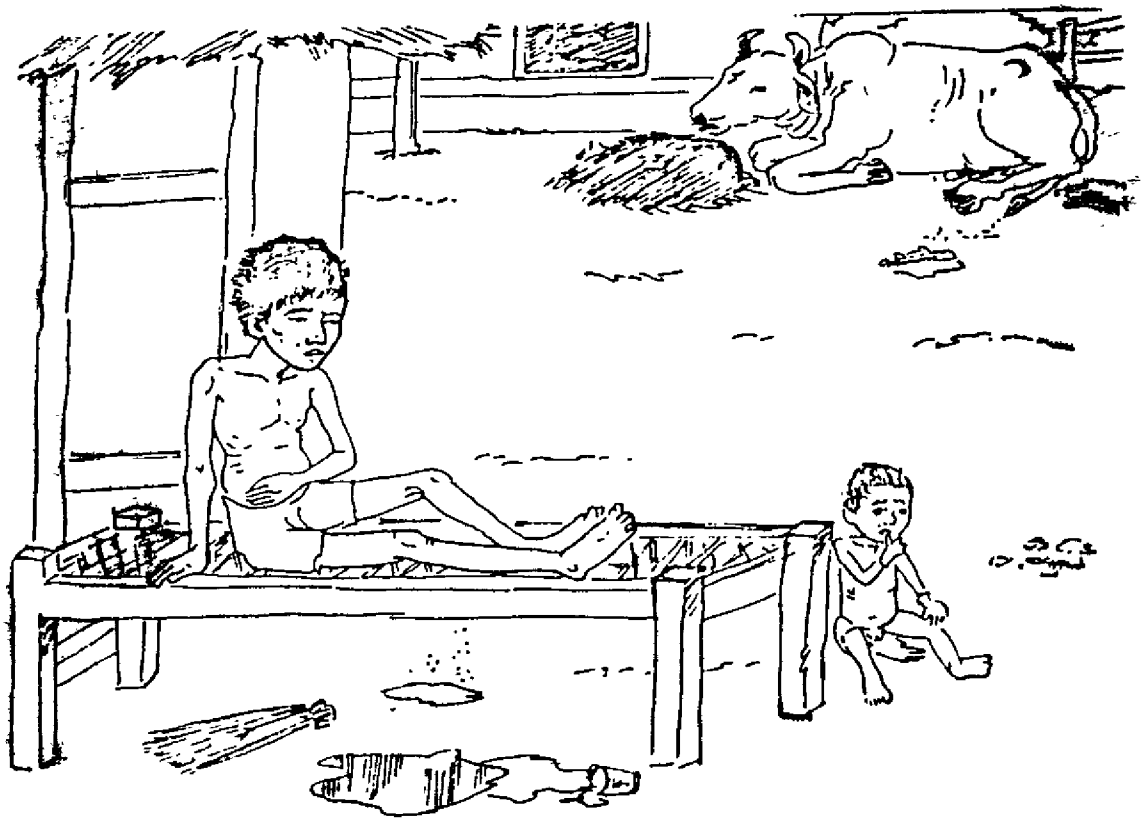
Slow Chlorination Using Indigenous Containers

- Make small holes at the bottom of a clay pot, coconut shell,used plastic container.
- Add some stones for weight.
- Fill with the above mixture.
- Immerse the container in the well or tank and secure it with a rope.
- The mixture has to be replaced periodically.

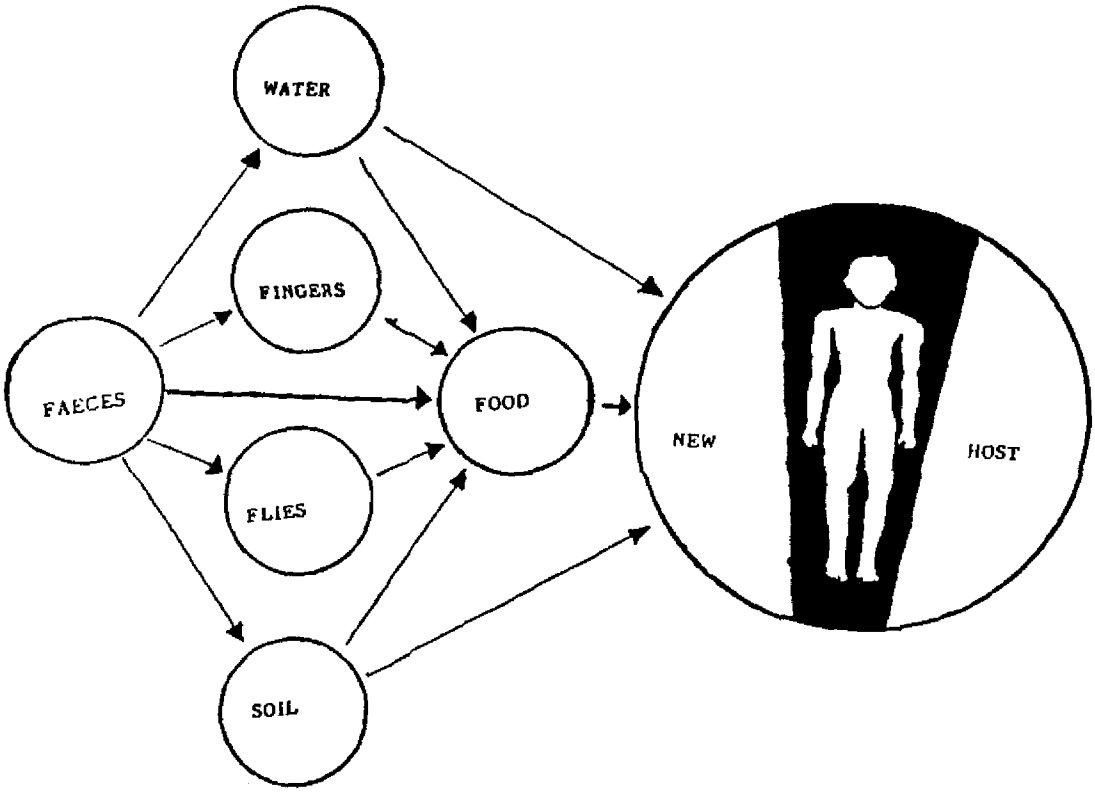
SANITATION

Typical Unsanitary Situation Leads To :

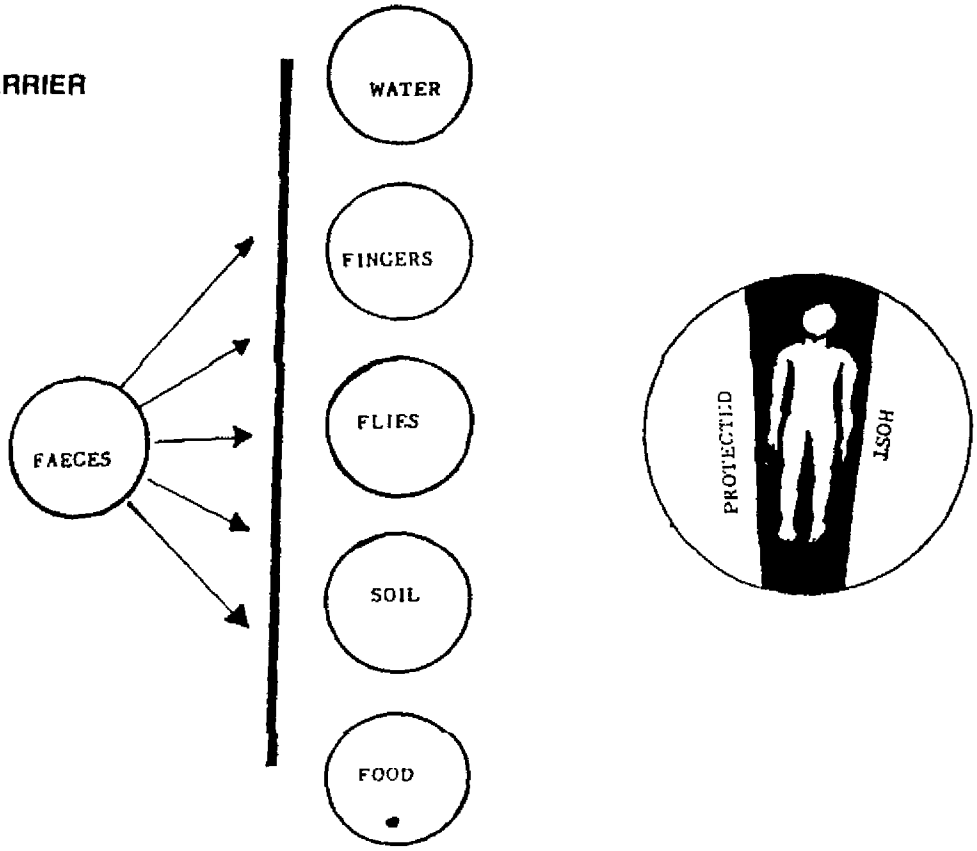
- diarrhoea.
- Worm infestation
- illness
- depression
- smell



TRANSMISSION OF DISEASES FROM FAECES



SANITATION BARRIER



Sanitary Latrines

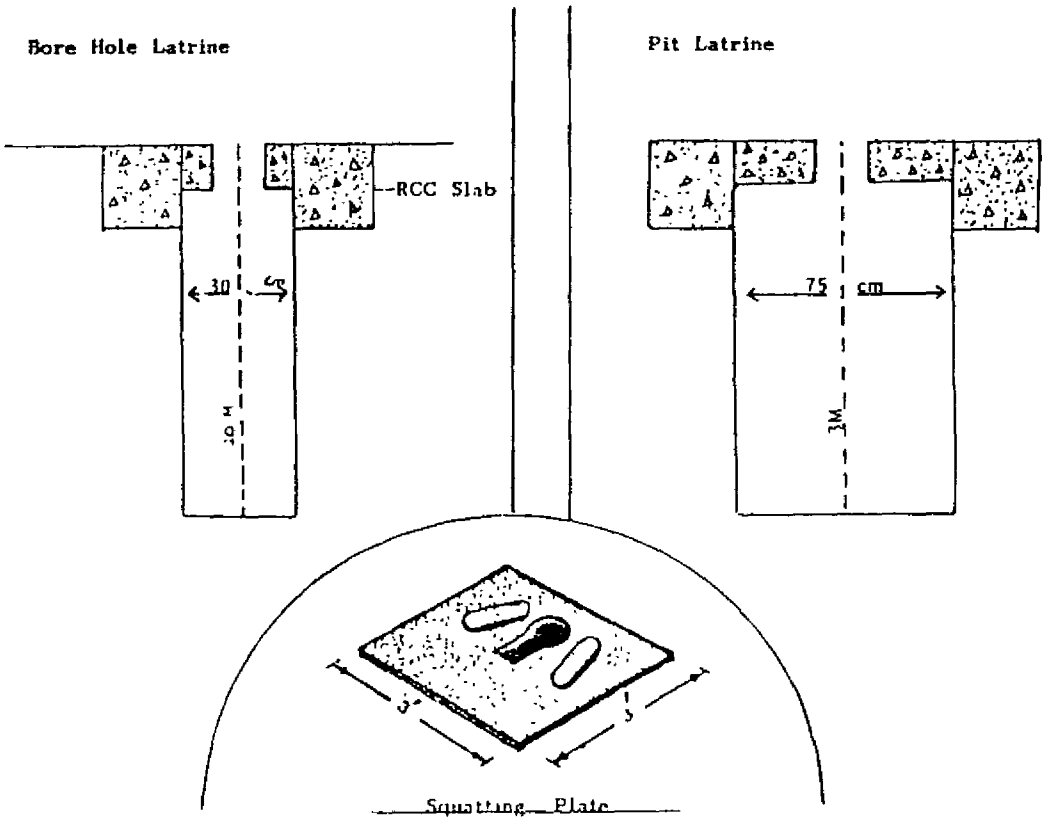
- Excreta should not contaminate the ground or surface water.
- Excreta should not pollute the soil.
- Excreta should not be accessible to flies, rodents, animals (pigs, dogs, cattle etc.) and other vehicles of transmission.
- Excreta should not create a nuisance due to odour or unsightly appearance.

Borehole Latrine:

- This is a variation of the pit latrine.
- Special equipment is needed to dig the pit.
- This is a deep vertical hole with squatting slabs on either side.
- This fills up faster than an ordinary pit latrine.
- It is prone to fly and mosquito breeding.

Pit Latrine:

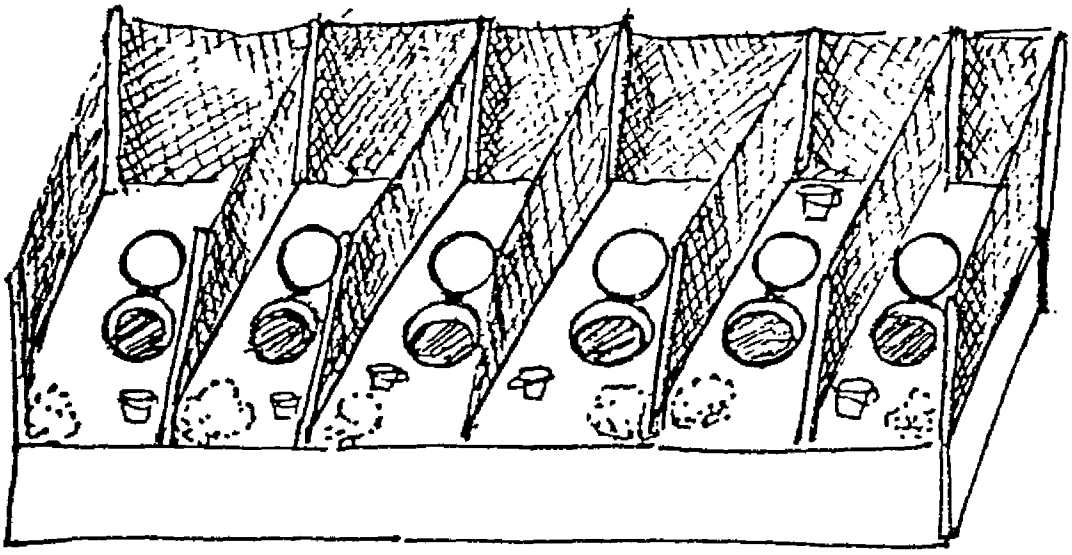
- This is the most common sanitation facility used in an emergency.
- A pit is simply a hole in the ground into which excreta fall.
- It has a squatting plate or riser and a superstructure.
- When the pit is filled to within one meter of the surface, the superstructure and the squatting plates are removed and the pit filled up with soil.
- A new pit is then dug nearby.



Trench Latrines

These are for temporary use as for camps and festivals.

A long pit is dug and divided into compartments by means of sack cloth, thatches or wood In each compartment, the pit is closed on top except for a hole adequate for defaecation. A cover is provided for the hole. In each compartment earth from the trench is piled on a side which is used to cover the faeces after each time of usage. Water for ablution is provided. Super structure could be provided with poles and thatched leaves.



DIMENSIONS

Length = 10 feet per 1000 people.

Width = 1 foot.

Depth = 3'-5' if temporary. 6'-8' if for more than 1 week.

When the trench is filled up to 1' below ground level, it is covered with earth heaped above ground level and compacted.

Separate trenches are provided for women and men.

It is supervised atleast twice a day to ensure cleanliness.