MUTAGUBYA ADAM. [redacted]

ENVIRONMENTAL HEALTH SCIENCE

Def: SSEKATAWA ABDUL AZIZ

Environmental Health Science is the study of the improvement/modification of our environment to promote good health OR this is regarded as a process concerned with the promotion and control of all those factors in mans environment which may exercise a deleterious effect on his or her physical social and psychological development and survival.

The components of environmental health that affect mans health include

1. Physical such as pollution of water, soil, air
2. Chemical i.e. toxicology and drug abuse heavy metals.
3. Biological comprises of disease causing organism — bacteria, virus fungi protozoa people animals, and trees,
4. Social cultural beliefs and customs, family kinship,
5. Economic and Political, rural and urban communities, leadership, policy development, political organizations.

Over 80% of our diseases are environmentally related and hence preventable some of the areas to focus on are;

- Proper refuse disposal
- Good housing
- Safe water supply.
- Proper excreta disposal
- Vector control etc

Public Health

The science and art of preventing disease, prolonging life and promoting health through organized community efforts for example health education, immunization, drug supply, control of communicable disease, provision of maternal and child health, services, food and nutrition, treatment of common disease, dental and mental health provision of proper sanitation and hygiene etc

Sanitation

According to UNICEF (1997) sanitation is a process where people develop and sustain hygiene and environmental health by erecting barriers to prevent the transmission of diseases. There is an extrinsic relationship between public health, environmental health and sanitation. Environmental health is a subset of Primary Health just as sanitation is a subset of environmental health.

Hygiene

This is the proper use and maintenance of facilities erected i.e. pit latrines hand washing facilities (HWF) and refuse pits.

COMPONENTS OF ENVIRONMENT

PHYSICAL ENVIRONMENT

This includes the air we breath; the water we drink and use for domestic purposes and the land in which we grow our food and yet we seriously degrade it.

It is suffice to acknowledge that the extent of pollution in urban/pen areas greatly exceed that of the rural areas.

In urban areas for e.g. the basic requirements of civilization are threats to the wellbeing of humanity which they are supposed to serve.

The transport industry heavily relies on automobile fuel which ends up polluting the environment, industrialization and urbanization are doing more harm than good, these are necessary evils that we can't do without.

Belching smoke from factories, noise of machinery and transport vehicles greatly degrade the quality of urban life.

The fundamental question is for how long we shall continue to foul our own nest for example human beings on average excrete between 100-250 grams of feaces per person per day alongside 1 litre of urine depending on age and diet.

Considering that approximately 50% of Uganda's population has no adequate sanitation the excreta degrades the environment in unprecedented levels.

The amount of solid and liquid waste generated in especially urban areas is equally enormous, studies have established that on average each resident in Kampala generates solid waste between 5000-800grams per day, the

majority of which becomes a nuisance because it's not managed well. It causes bad smells and acts as breeding sites for vectors such as rats, housefly's cockroaches, mosquitoes and acts as a health hazard to man.

CHEMICAL ENVIRONMENT

The chemical environment of man is diverse and has both advantages and disadvantages.

While most use of chemicals is well established i.e. drugs and pesticides they can also be detrimental to human health.

The chemicals such as heavy metals insecticides organophosphates are used by man but also force or present a health threat to man.

Heavy metals such as mercury chromium cardinum, arsenic and lead are generally toxic even in low concentrations to both plant and animal life.

Most of the industrial chemicals cause human allergy fibrosis fever and systemic poisoning these include — chlorinated hydro carbons e.g. DDT Dioxyn asbestos

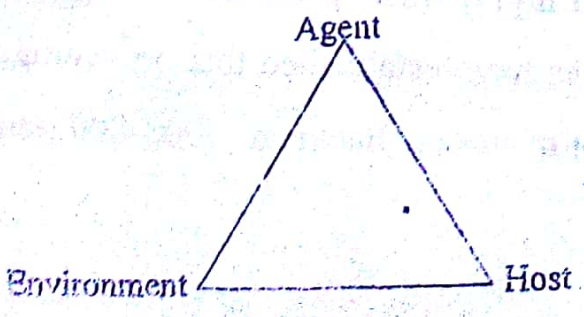
The other categories are the organophosphates such as diazinon and malathion, these in addition to the above effects have the potential to cause mutation (carcinogenic) affect the CNS

BIOLOGICAL ENVIRONMENT

Biological include-bacteria, virus, protozoa, and fungi.

Epidemiologically there are factors required are for communicable diseases to spread from man to man. .

These are the agent, the host, and the environment.



These interact with each other to make what is called the epidemiological triad. The interaction of the three factors may result into any of the following

i). No disease at all i.e. (natural or artificial immunity) harboring disease organisms and body immunity being able to fight it off i.e. TB

ii). Disease (signs and symptoms)

This will lead to ill health and reduced productivity.

It may be due to immune suppressing disease i.e. malnutrition, cancer and

HIV/AIDS

iii). Outbreaks

.In developing countries many people especially children suffer from intestinal worms but a few or no children show evidence of illness.

A lot of environmental factors influence how a person feels and functions, among the reduced ability to function because of ill health, this illness is environmentally induced

Thus the isolated societal elements of poverty, poor housing, and lack of safe water overcrowding and family instability are a major aspect of environmental health. Raising levels environmental pollution is responsible for most of the communicable diseases malaria, intestinal worms, trachoma and non communicable diseases i.e. cancer, asthma and diabetes.

SOCIAL, ECONOMICAL, CULTURAL AND POLITICAL ENVIRONMENT

The day to day's life in most developing countries culture is undertaken to be a taboo emanating from the illiteracy of the people, there is potential alternative in the way of living.

In some societies in Uganda the management of excreta still causes a fundamental challenge as a result of negative beliefs and taboos e.g. there are some cultures that believe that if a pregnant woman uses a pit latrine she can lose her baby into latrine, so they deposit their feacal matter into the environment.

Human suffering due to emergencies and disaster compared with lack of general awareness has lead to spread of diseases.

Equally these factors reduce nation's ability to produce goods and services creating a vicious cycle of

- Poverty
- Backwardness and disease at the same time poverty and illiteracy greatly contribute to ill health and diseases as much as ill health can contribute to poverty and backwardness.
- Let it be noted that all over the world the poor spend much money on health than the rich e.g. in USA it is estimated that the poor spend 15% of their money on healthcare compared to only 3% of the money spent by the rich annually.

Communities that are poor live in a delicate environment and consequently pay highly to be served in terms of medical care, this leading to high morbidity and mortality which in turn translates to low life expectancy.

Purpose of Environmental Health Science

This is to ensure good health by trying to stop people getting disease (prevention). The second is looking after those who have got the disease (treatment and care). The two together amount to control. Doing one without the other is doing only half the job (Def of Health according to WHO).

The relevance of Environmental Health Science to a Clinical Officer.

- A Clinical Officer needs to understand human behaviour and his environment surrounding) which greatly influences good health or may on the other hand influence bad health.
- The environment one lives in determines the kind of health he/she or the community will lead, i.e. a good sanitary environment with all facilities will reduce the spread of diseases. The commonest diseases in Africa today are communicable or environmental and are preventable.

Note:

Some changes in the environment may improve on health while others damage or destroy it called environmental degradation.

Management of factors in the physical environment that may cause disease is what is known as environmental sanitation/hygiene.

Approaches to health service de livery

Traditional Approach

This was basically focused on curative health, thus treatment of the patient who would go back to the community where he/she comes from and is likely to infect others through the various transmission routes due to ignorance and health workers made no follow-ups.

New Approach

This approach addresses the community where the patient lives, medication and follow-up is made

The combination of the two preventive and curative health is very effective in the management. prevention and control of disease hence health promotion in the community.

Benefits of Preventive and Curative Health Services

- It's cheap
- Its sustainable
- Has a long lived effect
- Community and health workers are capacity built — disease surveillance
- Reduced workload on health workers
- High community participation

Multi-sectoral Approach

This is the involvement of all sectors in the prevention and control of diseases which has a more long lasting, these include

- Agriculture and fisheries (nutrition promotion)
- Education
- Finance (IGA)
- Gender and community development
- Political organizations, policy formulation.

SSEKATAWA ABDUL 4/12

WATER AND WATER SUPPLY

Introduction

Objectives

1. Identify different states of water
2. Mention the uses of water
3. Identify different sources of water
4. Mention dangers associated with water
5. Explain how to overcome the dangers
6. Demonstrate how to protect different water sources
7. Demonstrated how to pass health messages related to water to communities
8. Mention methods of water treatment

Introduction

Water is a combination of two gases; hydrogen and one oxygen in the ratio 2:1 respectively represented by the formula H_2O (H2O).

Water is a universal solvent.

Water can be in form of liquid, gas, solid.

Its colour less and odour less

Only one percent (1%) of the earth's water is accessible fresh water, on the earth's surface sources being lakes, rivers, streams and underground sources i.e. shallow wells, springs, and boreholes.

People can also harvest rain water for domestic use.

Water is necessary for the existence of all living things. The human body requires 2-10 liters of water for normal physiological functions depending on the intake.

A minimum of 20-40 liters of fresh water per person per day is the minimum standard for basic needs drinking sanitation i.e. bathing and cooking.

Properties of water

a) Water in Gaseous form

When water is exposed to air, it evaporates H_2O in gaseous form retains the chemical formula – the molecule does change.

If H_2O is heated in expands and changes rapidly into vapour called STEAM. The boiling point 100^0C (212^0F) expands 1700 times more than its original capacity in a liquid form.

Water supply turns into vapor by evaporating if left in air.

Uses of water in gaseous form

a) It is used to acquire pure water
b) It is used in hospital laboratory, factories, in batteries
c) For sterilization
d) Part of H_2O used as a liquid

b) Water as a liquid

When water cools before the boiling point, it turns into a liquid

At its conversion to liquid form in clean sterile containers it is pure. It is capable of dissolving many substances (universal solvent) when they come into contact with it.

It has no shape and finds its own level. It is not common to pure H_2O under nature condition and mostly used with contents at tolerable levels.

USES

1. Sustain human, animal and plant life, drinking
2. For domestic purposes e.g. cooking, washing etc
3. For industrial uses
4. For power generation e.g. hydro-electric power
5. For cooking engines
6. For recreation e.g. swimming, yachting etc
7. Transport on seas, lakes etc
8. Fire fighting

Water as a liquid solid

a) Water continues to cool and become as solid at 32^0F or 0^0C

b) It is $1/10^{th}$ less than original volume

c) A current is created as cold H_2O from top sinks to bottom and warm H_2O from bottom rises to the surface has maximum density. Water on the surface expands and floats because it is less dense than H_2O at the bottom. This is called FREEZING this continues until water has turned into an ice block.

Uses

1. For anesthetic properties medically (anesthetic)
2. Preserves food, drinks etc
3. Fire fighting
4. For sports e.g. skiing
5. Maintenance of the cold chain

What is the importance of water?

i. Water is essential for various services as seen above in different forms
   It is essential in selecting sits for new home
   It influences sitting of towns. It is important for as reasonable distance for the users

ii. Water doesn't remain in one state and dissolves in many gases and minerals. The solvent can easily be dangerous to man, so man must be on a look out.

iii. Water as a gas can scaled

iv. In liquid form, one drowns

v. Water can support the life of some diseases organisms and is direct or indirect responsible for the spread of diseases such as diarrhea, cholera, malaria, bilharzia etc

   The spread occurs under optimum condition which is present in Uganda
   Having recognized the uses and dangers it is important to carefully use it so that it is always our advantage.

SOME COMMON TERMS USED RELATING TO WATER

Wholesome Water

Water which can be consumed without any risk from its bacterial or chemical content

Contaminated water

It is water which contains pathogenic organisms or chemical rendering it dangerous for human consumption.

Polluted water

Is water that contains undesirable matter that renders it undesirable for human consumption. Discharge of material or energy into water, land or air that causes or may cause acute (Short term) or chronic (short term) detriment to health.

Palatable water

Water which is free from pollution and has a good taste

Portable water

This is wholesome and palatable water

This is a state required of all water sources or water works

Suspicious water

Water that can be doubted whether it causes disease (suspected for not being safe)

Turbid water

This is water which has taken colour of suspended particles in it eg mud. This does not allow light to go through it easily.

Pure water

Is distilled water, it is not consumable but used eg in laboratories and hospitals.

Impurities

Is substance in water which renders it dangerous for use or unfit for use for fear of effort on user's health.

How does water move in the stratosphere. (Hydrological cycle)

The biggest force for water movement is heat from the sun, by the hydrological cycle heating water bodies with light as energy for photosynthesis, transpiration in plants forming water vapor that evaporates to form clouds then rain.

The rain falls, water runs off and soaks into the ground replenishing our ground water and recharges the hydrological cycle, it supports vegetation growth that reduces soil erosion.
Trees are very important in the water cycle as they reduce evaporation from the ground hence maintaining the water shade.

Most of our communities are interested in the rain that falls to supply our water needs not what happens after it has fallen. As water moves being a universal solvent it collects a lot of contaminants and pollutants and ends up polluted or contaminated causing disease transmission.

It is very important for Health workers to encourage communities to plant trees that they cut for fire wood and charcoal. They should be advised to plant indigenous trees not exotic i.e. eucalyptus as may be of harm to the environment.

Hydrological Cycle sketch

Two main classifications of water supply.

1. Surface water
2. Under ground water

Surface water includes the following:

Lakes, rivers, seas, swamps, ponds, rainwater, upland surface water seepages valley tanks.

Under ground water includes the following

Boreholes, springs, wells.

SOURCES OF WATER SUPPLY

SURFACE WATER

This is water collected from the ground of natural or artificial reservoirs. It can be running or stagnant

The following are possible sources of surface water

1) Upland surface water
2) Lakes
3) Rivers
4) Ponds

5) Dams

6) Valley tanks

7) Seepages

These can be sources of large scale and small scale water users

Upland surface water

This is water from a source reservoir which is above habitable places. This reservoir is filled by surface runoff from un-cultivated land..

It is an excellent quality being soft, free from sewerage and other contaminants.

The gathering area of the reservoir (catchment area) is the area bounded by the water shade line, i.e. a line on either side of which water flows onto the opposite

When this water is used for domestic purposes it must be treated by filtration and disinfection.

A reservoir can be made or increased in capacity by (damming) some water must be allowed to continue it natural course.

The water allowed to flow is compensation water meant for those previously using the water.

GRAVITY FLOW SCHEME

A gravity flow scheme is a water supply system in which the force of GRAVITY is used to transport water from a high point to a lower point.

The system often covers many square (km) in an area and supplies thousands of people.

The system starts with an intake which can be a river or a spring: from the intake the water flows through a pipe to the treatment installation. The type of treatment depends on the quality of raw water.

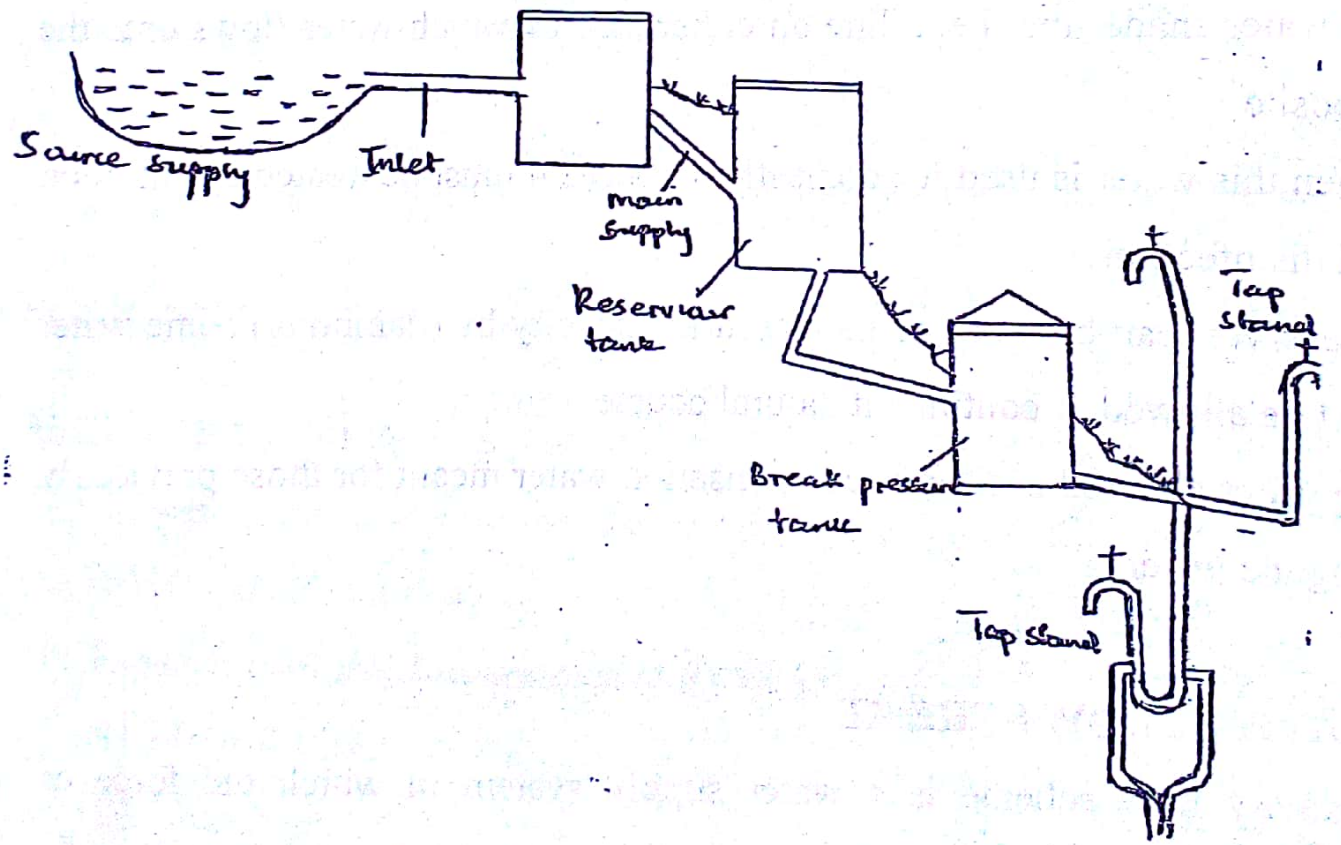
Spring water is usually of good quality and treatment is minimum commonly

Depending on the yield of the inlet and the water demand, reservoir tank may need to be constructed.

The water demand depends on the water uses in the family/community — discuss uses of water.

In most rural areas it is 5-30 liters a day due to a number of reasons.

GRAVITY FLOW SCHEME



A gravity flow scheme has no need for extended power supply, only a sufficient pressure

head is required to transport water.

The choice of the system will therefore depend on:

- The safe yield of the source, yield in the dry season
- Possible location of the stand pipes
- The topography of the area and the profile of the pipeline
- The financial limitation

Steps of identification and construction

Identification of source - by extension worker

a) Mobilization — by extension worker
b) Water resource study — consultant
c) Tender process and award of contract - district (LG)
d) Constructor, supervision — consultant

Roles of water source committee (wsc)

- Promotion of sanitation improvement (safe water chain)
- Attend meetings relation to O&M of the GFs
- Formulating and abiding by the bye-laws
- Selection and training of GFS committees and tap stand committees
- Payment of funds for the overall management of the GFS and funds for maintenance of tap stands
- Cleaning tap stands environment and creating a soak way for waste water.

Water Demand

Water demand is the amount of water we need to use for our day to day needs.

Water consumption per capita per day is determined by several factors such as
availability, distance, quality, income level, family size, income level, cultural,
standard of living, habits, climate and means of distribution.

LAKES AND RIVERS

These are the most common and most important of water supplies in all countries.

It should be noted that most or all the rivers are polluted and therefore supply depends on purification and oxidation that takes place.

How River water gets polluted

- Collects pollutants as it runs down its course
- Sewerage may be discharged into the river
- Insanitary habits of the inhabitants along the river
- Industrial wastes
- Fertilizers and pesticides being washed into rivers by stream water

Rivers as a Source of water supply for small communities

River Zoning

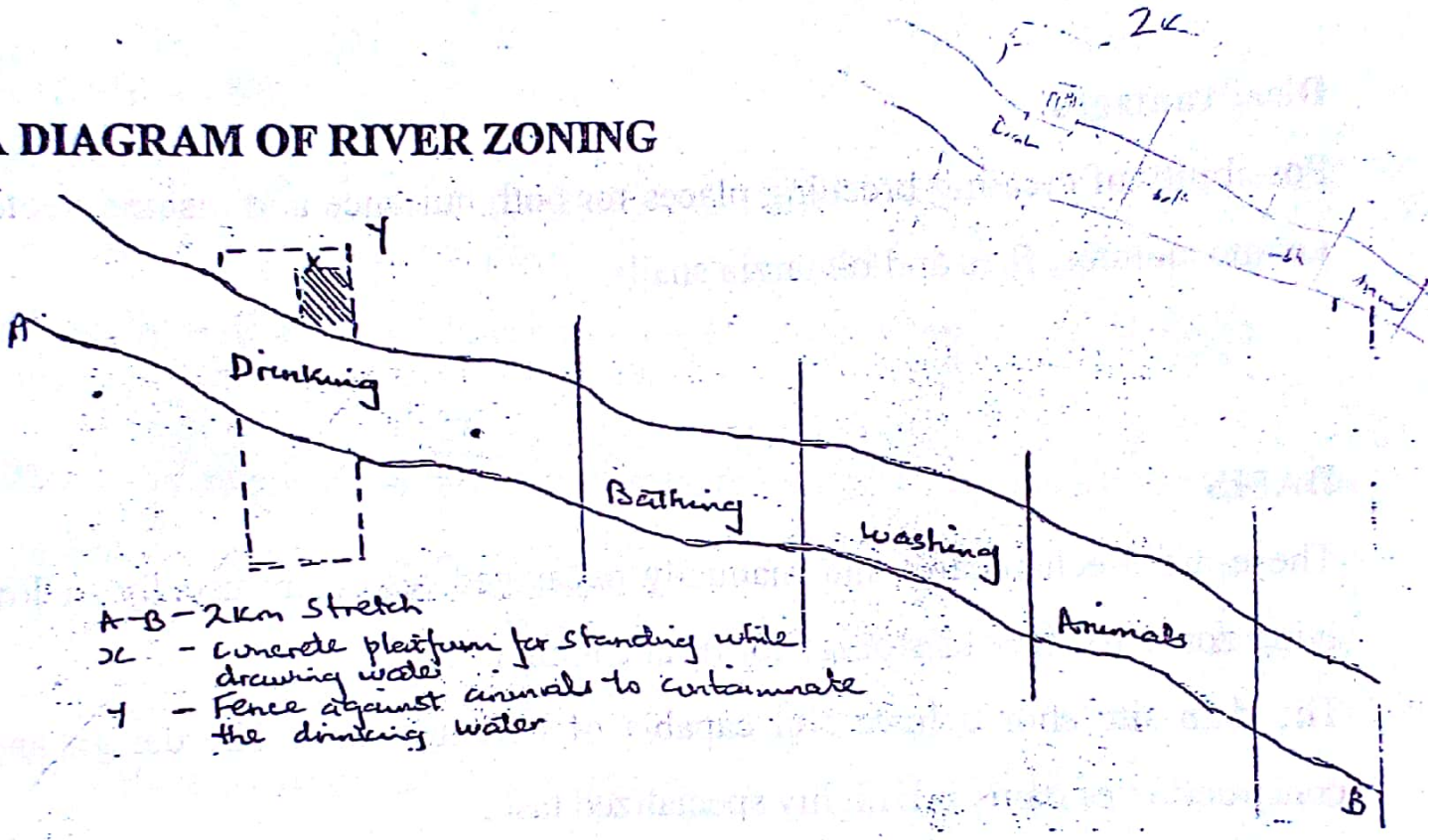
For small communities rivers should be divided into sections for human use this is called zoning.

The upper section should be protected and used for human consumption (drinking)

The section should be fenced and a platform be provided for people to stand on while drawing water, this excludes mud production on spot of collection The other sections can be used for bathing; washing and watering animals for (2km) then repeat the zoning.

People using the river must be advised to allow water to sediment and boil it before use

A DIAGRAM OF RIVER ZONING



Discuss river zoning sedimentation, oxidation and ultra violet rays.

PONDS AND RESERVOIRS

These provide an abundant supply of water for use in rural as well as urban water usually collected from upland streams.

Quality

The quality of water may require little treatment if the following measures are taken

- Exclusion of campers and swimmers from the water shade and reservoir by fencing
- Exclusion of animals and human pollutants
- Clearing submerged area of all vegetation and decaying matter and provide ample water storage by regular distilling and allowing self purification

Disadvantages

Possibility of creating breeding places for both nuisance and disease vectors i.e. mosquitoes, flies and bilharzia snails.

DAMS

These are mechanically and manually excavated reservoirs usually in low lying zones to serve as storage for rural communities.

The dam site should have soil capable of holding water. The design and construction of dams is a highly specialized task.

Quality

The water may acquire the colour of the intervening soil. It may be whitish or yellowish. It should be boiled before use as drinking water

QUALITIES OF GOOD WHOLESOME WATER

1. Free of pathogens
2. Containing no compounds that have adverse effects, acute or long term
3. Fair clear (low turbidity and little colour)

4. No saline (salty)
5. Containing no components that cause offensive taste and smell
6. Causing no corrosion, encrustations of water supply system and utensils

RAIN WATER

The hydrological cycle

The source of all water supplies is the natural rain cycle which is continuous events involving falling of water into land inform of snow or rain drops.

The water required for ordinary purposes can be taken out of the cycle in any of the following ways:-

1. Collecting water as it falls e.g. direct rainfall on clean surfaces ie corrugated iron sheets (CTS)

   Rain water is the purest natural water source, it has no pathogenic organisms or minerals and only gets contaminated or polluted when not properly collected or stored.

   Rain forms as a vapour which is produced by evaporation from lakes, rivers ponds, streams and oceans plus transpiration from plants then down as a precipitate (rain) it has no solid impurities until it falls on dirty surfaces.

   Rain water cannot be relied upon as a source because it may not rain for a long time and also very big tanks will be required to store enough water during day periods.

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RAIN WATER COLLECTION/HARVESTING

The amount and safety of water collected depends on

1. Amount of rainfall
2. Collecting surfaces
3. Storage tanks
4. Contaminants in the atmosphere

Components of Rain Water Harvesting

- Roof, gutters, pipes, water tank, tap.

Collecting surfaces

- Ground catchment
- Roof catchment – gutters and channels to direct water to storage

Roof catchment

- Corrugated iron sheets (CIS) plastic roofing tile surfaces which are provided with guttering with good slopes

  Note: avoid asbestos – likely to cause asbestosis also do not paint roofs.

Ground catchment

This can be done by compacting and paving the ground using tiles, slabs, asphalt, plastic concrete etc to give impervious surfaces

Channeling the surfaces to direct water to storage facilities

Excluding contamination from collection surfaces

This is done by

- Fencing/planting hedges
- Planting grass
- Cutting away some branches
- Slashing
- Digging channels around the collecting ground to exclude storm water
- Constructing silt traps which help to exclude silt
- Raising collecting ground above surrounding area

PLAN OF A GROUND CATCHMENT

Note:

Ground level surface catchment is risky due to high chances of feacal contamination.

STORAGE OF RAIN WATER

There are many methods of storage of rain water. These include pots, drums, tanks made from galvanized iron sheets, plastic, concrete, bricks and ferrocement. These tanks can be above or underground.

1. Above ground tank construction

- Galvanized iron sheets or galvanized corrugated iron sheets are specially moudled and rebated to form a tank
- They are provided with a washout at the floor of the tank; draw off tap (95-120mm) above the floor of the tank, an access for cleansing purposes, and inlet for the water and an overflow when tank is full.

The tanks may be given a paint outside the prevent rusting – do not last for more than 5 years in dump climate.

A platform which is constructed of bricks is provided for the purpose of placement of the tank.

Plastic tanks

Plastic tanks are similar pre-cast; these are sold in units ready for installation

- Ferro cement-durable
- Traditional basket jar will crumble about 4 years

2. Underground tanks

An alternative to the above gorund tank is the underground tank

Conditions favouring construction of underground tanks are

- More water is stored
- Keep water cool
- If covered inhibits growth of algae
- Collects water from various surfaces equally well
- Suitable for use where there are fairly big communities
-

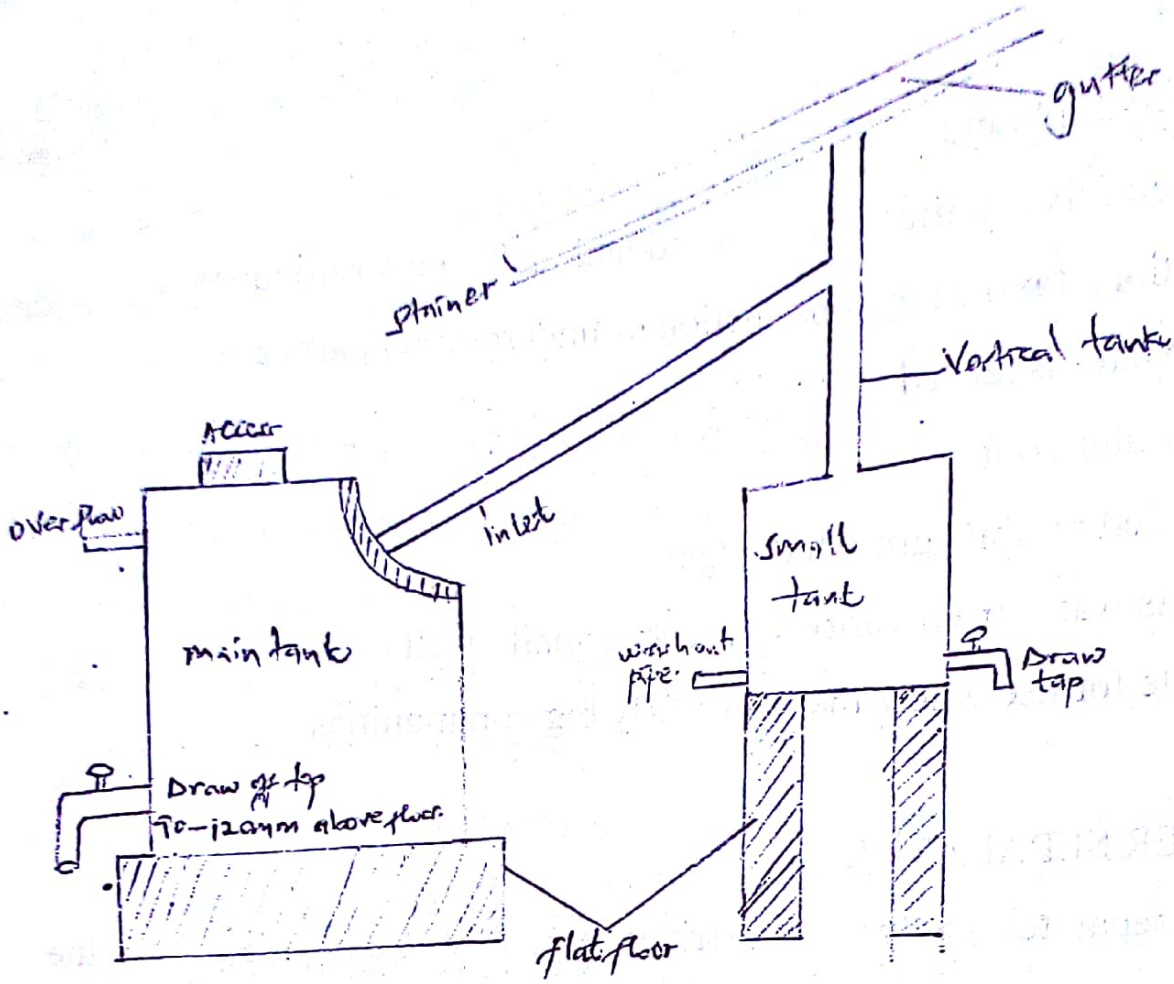
RAIN WATER SEPARATOR

Rain water separator excludes impurities e.g. dust from going into the storage tanks of harvested water from the collecting surfaces.

When rain water falls on the collection surfaces, it runs to the gutters, this water washes the surfaces of the roof and flows to a vertical pipe connecting to a small waste water tank. Dirty water flows into the small tank, as rain continues; water becomes cleaner, when water reaches the level of the angel pipe, clean water gains access to the inlet of the main tank for storage.

The water in the small tank can be used for domestic purposes other than drinking.

DIAGRAM OF A RAIN WATER SEPARATOR AND RAIN WATER TANK



Perforation of gutters

The clean water can also be separated by perforating gutters at suitable intervals when it rains the dirty water washed from the roof passes through the holes and as it continues to rain clean water is collected.(Will flow to the tank often increasing in volume). The smaller the volume the less the pressure

MEASURES TO COLLECT CLEAN RAIN WATER

Pollution of water is expected as there is particularly no pure water under natural conditions. Water is a universal solvent and therefore dissolves minerals and gasses; it comes into contact with.

Pollution from the atmosphere

It takes place if water passes through polluted atmosphere eg gases and duet gases include hydrogen, sulphide, carbon dioxide, ammonia, methane, these form carbonic acid, nitric acid etc.

Pollution during collection

- Unhygienic behavior e.g. defecating, urinating on collecting surfaces
- Dust blown about by wind onto the collecting surface
- Leaves, bird droppings, insects and other organisms collected on the collecting surfaces and are washed into the collecting tank

Prevention

- Do not collect water (rain) in dusty environment or where industrial fumes are plentiful
- Use of a filter or a strainer to be provided at the inlet of the storage tanks
- Gutters or collecting surfaces and channels use to collect water should be cleaned at all times
- Provide rain water separators or perforate the gutters to enable exclusion of dirt
- Dig channels around underground tanks/collecting surfaces to interrupt storm water
- Cutting some trees and branches from around the collecting surfaces
- Planting hedges and grass around ground collecting surfaces
- Boil all drinking water
- Health education on methods of prevention of pollution/contamination

Pollution during storage

a) Surface water/stream water is likely to run into underground tanks if tanks are not sufficiently above ground level.
b) Contamination may gain access into the underground water if they are not water tight tanks
c) Dirty collecting and drawing utensils can contaminate water during storage
d) Unhygienic practices eg pouring water from drawing utensils
e) Animals gaining access into storages tank area incases of storage tanks
f) Algae is likely to grow in the tanks giving bad taste and smell

Prevention

i) Dig channels around the tanks
ii) Make tanks water tight
iii) Health education to avoid unhygienic practices which can lead to water contamination
iv) Fencing tank area to exclude animals
v) Exclude sunshine and add chemicals to prevent growth of algae

ALGAE

Whenever water is exposed to the sunshine and air algae gains access to water as weed gains access to gardens. The growth of algae into tanks has the following disadvantages

a) Production of turbidity (suspended matters)

b) Coloration of water (greenish)

c) Taste and odours undesirable in water for consumption

d) Clogging of filter beds if water is filtered

Factors encouraging growth of Algae

i) Stagnation of water

ii) Presence of mineral substances which encourage growth of algae such as silica and phosphates

iii) Exposing water to sunshine

iv) Temperatures of $60^0F - 70^0F$

v) Moderately high PH value in water alkaline medium

Prevention of Algae Growth

The most important measure is to exclude sunshine/sunlight though this becomes impossible to apply in some water tanks, source supply reservoirs and swimming pools.

Addition of chemicals

Copper sulphate

Chlorine

Copper sulphate dosage is 0.5 – 2mg/litre

Chlorine should be used inform of chloramines at dosage of 0.2-0.5mg/litre

How to exclude algae using chemicals

i) Secure a mixture of the chemicals to be used (algaecide)

ii) Empty the tank then clean

iii) Scrub the surface of the tank to remove algae growth