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ENVIRONMENTAL HEALTH

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ENVIRONMENT

- Old French word, En=In; Viron = Circle.
- The circumstances, objects, or conditions by which one is surrounded.

Or

- The complex of climatic, edaphic (soil-based), and biotic factors that act upon an organism or an ecologic community.

ENVIRONMENT

- Environment is the total of the natural conditions under which animals live, including climatic, geographic, physiographic and faunal conditions; all that which is external to the individual human host.

PUBLIC HEALTH DEFINITION OF "THE ENVIRONMENT"

- All that which is external to the individual host. [It] can be divided into physical, biological, social, and cultural factors, any or all of which can influence health status in populations.

  - Last, J. M. (Ed.). (1995). *A Dictionary of Epidemiology* (3rd ed.). New York: Oxford University Press.

WHO DEFINITION OF ENVIRONMENTAL HEALTH

- Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, biological, social, and psychosocial factors in the environment. It also refers to the theory and practice of assessing, correcting, controlling, and preventing those factors in the environment that can potentially affect adversely the health of present and future generations.

ENVIRONMENTAL HEALTH SCIENCE

NIEHS charter of England: “The study of those factors in the environment that affect human health.”

- Factors (“pollutants" or “toxicants”) in air, water, soil, or food.
- Transferred to humans by inhalation, ingestion, or absorption.
- Production of adverse health effects.

CONTRIBUTORS TO THE "ENVIRONMENT"

- Physical:
  - Air, water, soil, housing, climate, geography, heat, light, noise, debris, noise etc.
  - Air pollutants, toxic wastes, pesticides etc.
- Biological:
  - Virus, bacteria and other microbes, insects, rodents, animals and plants
  - Disease producing agents, reservoir of infection, intermediate host and reservoirs of infection,

CONTRIBUTORS TO THE "ENVIRONMENT"

- Social/psychosocial/socioeconomic:
  - Culture, values, customs, habits, morals, religions, education, lifestyle, community life, health services, social and political organizations.

BASIC REQUIREMENTS FOR A HEALTHY ENVIRONMENT

- Clean air
- Safe and sufficient water
- Safe and adequate food
- Safe and peaceful settlements
- Stable global environment

SCOPE OF ENVIRONMENTAL HEALTH

- Water supplies
- Waste water treatment
- Waste management
- Vector control
- Prevention and control of land pollution
- Food hygiene and safety
- Air quality management
- Environmental radiation hazards
- Occupational health and safety
- Environmental noise management
- Accommodation establishments

SCOPE OF ENVIRONMENTAL HEALTH

- Environmental impact assessments
- Port health
- Accident prevention
- Environmental health aspects of public recreation and tourism
- Environmental health measures associated with epidemics, emergencies, disasters and migrations of populations
- Establishment of an effective environmental health surveillance and information system
- Research on environmental health issues

WATER AND HEALTH

Safe and wholesome water

- Free from pathogenic agents
- Free from harmful chemical substances
- Pleasant to taste, i.e. free from color and order,
- Useable for domestic propose

Water requirement

For drinking purpose: 2 liter/person/day

Domestic purpose : 150-200 liter /person/day

WATER AND HEALTH

Uses of water

- Domestic uses; Public purpose; Industrial purpose; Agricultural purpose; Hydropower production.

Source of water

- Rainwater, Surface water; Ground water.

Water pollution

- Sewage, industrial and trade pollutants, agricultural pollutants, physical pollutants and radioactive substances.

WATER PURIFICATION

1. Purification in small scale
   - Household level: boiling, chemical disinfection & filtration.
   - Disinfection of well
2. Purification in large scale
   - Slow sand filter
   - Rapid sand filter

WATER BORNE DISEASE

- ***Viral:*** Viral Hepatitis A, Hepatitis E, Poliomyelitis, Rotavirus diarrhoea etc.
- ***Bacterial:*** Typhoid & Paratyphoid fever, Bacillary dysentery, Cholera, Esch. Coli Diarrhoea etc.
- ***Protozoal:*** amoebiasis, giardiasis.
- ***Helminthic:*** round worm, thread worm, hydiatid disease.
- ***Snail:*** schistosomiasis.
- ***Cyclops:*** guinea worm, fish tape worm.

WATER RELATED DISEASE

- Acute and chronic toxic effect of chemical pollutants
- Disease associated with inadequate use of water
- Dental health problem: 1gm fluoride/liter water is beneficial for dental health.
- Vector borne disease: Malaria, filaria etc.
- Cardiovascular disease: hardness of water have beneficial effect on hardness of water.

Water Quality Criteria and Standards

The guideline for drinking water quality recommended by WHO (1993 and 1996) relate to following variables:

- Acceptability aspects
- Microbiological aspects
- Chemical aspect
- Radiological aspects

ACCEPTABILITY ASPECTS

A. Physical parameters

1. Turbidity: < 5NTU (Nephelometric Turbidity Unit)
2. Colour: free from colour; upto 15 TCU (True Colour Unit)
3. Taste and odour: pleasant to taste and no odour
4. Temperature: cool water is more palatable.

ACCEPTABILITY ASPECTS

B. Inorganic constituents

- Chloride: upto 200mg/liter
- Calcium: 100-300mg/liter
- Ammonia: <0.2mg/liter
- Hydrogen sulphide: 0.05-0.1mg/liter
- Iron: 0.3mg/liter
- Sodium: 200mg/liter
- Sulphate: <250mg/liter
- Zinc: 0.3mg/liter
- Manganese: <0.1mg/liter
- Cupper: <1mg/liter
- Aluminum: 0.2mg/liter
- PH value: 6.5-8.5
- Dissolved oxygen: no guideline
- Total dissolved solids: <100mg/liter

MICROBIOLOGICAL ASPECT

1. Bacteriological indicator
   a. Coliform organism
   b. Faecal streptococci
   c. Cl. Perfringens
2. Virological aspects
3. Biological aspects
   a. Protozoa
   b. Helminthes
   c. Free living organism

BACTERIOLOGICAL INDICATOR

a. Coliform organism: Several region for choosing coliform indicators of faecal pollution are:

i. Easy to culture; even single E. coli can be culturable in 100 ml of water.
ii. They are foreign to the water and generally not present to water.
iii. They are present in greater number (normal human can excrete 200-400 billion E. coli)
iv. They resist natural purification
v. They live longer than other pathogens

BACTERIOLOGICAL INDICATOR

b. Faecal streptococci: It is the confirmatory test for faecal contamination. Some times (very rarely) E. coli doesn't present in water but if present streptococci than there is 100% faecal contamination.

c. Clostridia: The spores of clostridia are highly resistance against the disinfection. If only one spore of clostridia is present in water; it shows faecal contamination taken place in remote time.

VIROLOGICAL ASPECT

- Drinking water should be free from any virus infectious to man. At the level of 0.5% FRC all pathogenic virus will be destroyed including hepatitis A. when bleaching powder mix with 2.5 gram mix with 1000ml of water then Free Residual Chlorine (FRC) will be 0.7%/liter in water.

BIOLOGICAL ASPECT

a. Protozoa: Entomoba Histolytica, Giardia Lambia both should not present in drinking water and both slow and rapid sand filter are effective in removing protozoa.
b. Helminthes: Round worm, Flat worm etc. Even a single egg/larva can produce disease in man; should not in water. Guinea worm and schistosomiasis is hazard of unpiped water supply and source protection is the best approach in prevention.

BIOLOGICAL ASPECT

c. Free living organism: free living organism that occurs in water supply include fungi, algae etc. which interfere colour, odour, taste, turbidity etc.

CHEMICAL ASPECTS

1. Inorganic constituents
   - Arsenic, Cadmium, Chromium, Cyanide, Fluoride, Lead, Mercury, Nitrate & Nitrite, Selenium,
2. Organic constituents
   - Poly nuclear aromatic hydrocarbons and pesticides

INORGANIC CONSTITUENTS

- Arsenic: upto 0.01mg/liter
- Cadmium: upto 0.003mcg/liter
- Chromium: upto 0.05mg/liter
- Cyanide: upto 0.07mg/liter
- Fluoride: upto 1.5 mg/liter
- Lead: upto 0.01mg/liter
- Mercury: upto 0.001mg/liter
- Nitrate & Nitrite: upto 50mg/liter
- Selenium: upto 0.01mg/liter

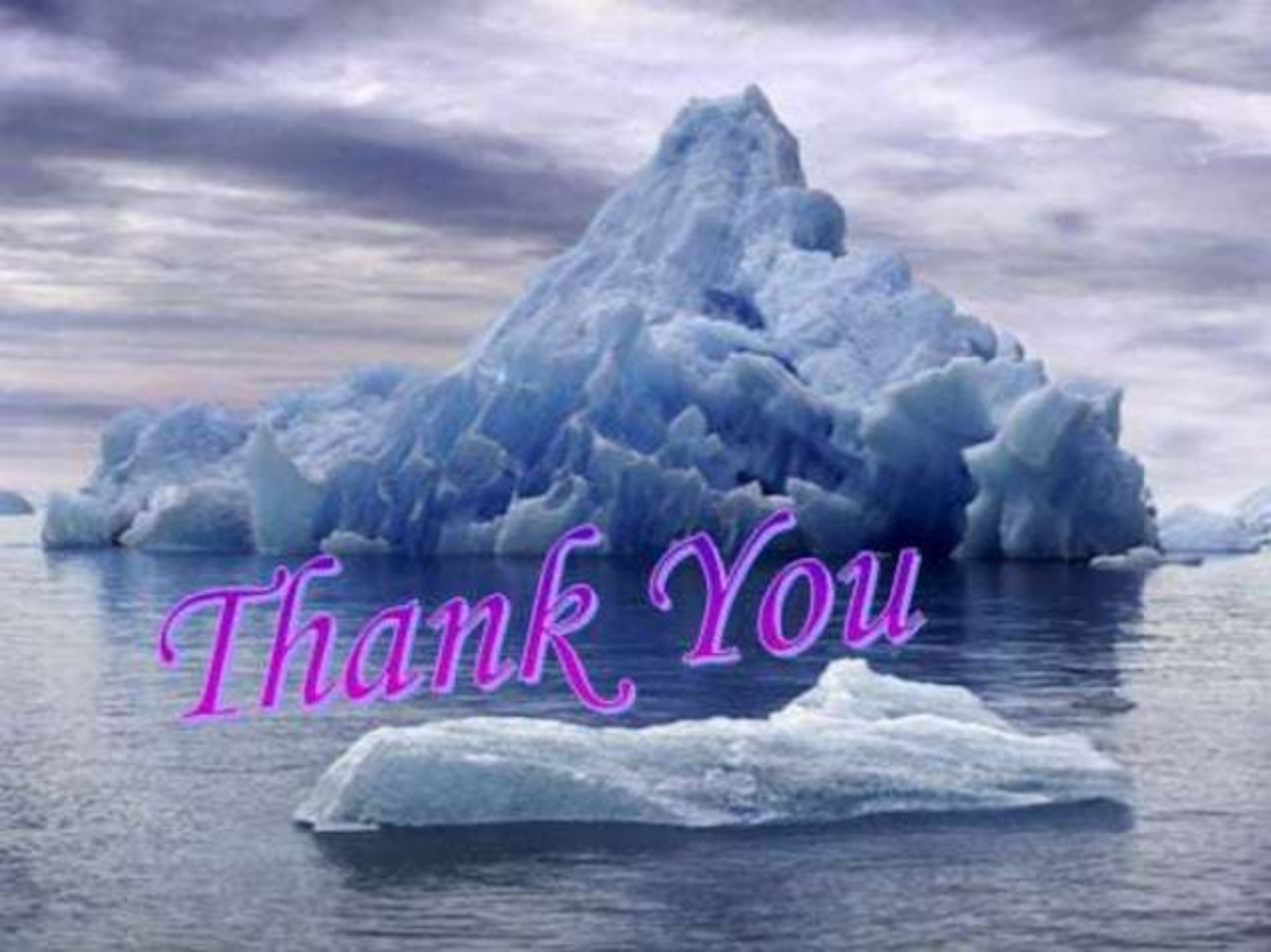
ORGANIC CONSTITUENTS

Organic constituents	Upper limit (mcg/liter)
Carbon tetrachloride	2
Vinyl chloride	55
Dichloromethane	20
Dichloroethene-1.1	30
Dichloroethene-1.2	50
Benzene	10
Toluene	700
Oxylenes	500
Ethyl benzene	300
Styrene	20
Benzolalpyrine	0.7

GUIDELINE FOR PESTICIDES

Pesticides	Upper limit (mcg/liter)
Aldrin/ Dieldrine	0.03
Chlordane	0.2
DDT	2
2.4-D	30
Heptachlor	0.03
Hexachlorobenzene	1
Lindane	2
Methoxychlor	20
Pentachlorophenol	9 (P)

*proximate value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AIR POLLUTION

- Daily requirement of air: about 10-20 cubic meter/day

Composition of air:

- Nitrogen: 78.1% by volume
- Oxygen: 20.93% by volume
- Carbon dioxide: 0.03% by volume
- Other gases (Ar, Ne, Kr, He etc.): 0.94% by volume

AIR POLLUTION

Presence of harmful gases, mixture of harmful gases and other particles in atmosphere, generated by human activity that interfere with human health, safety or discomfort and also affect other environmental media resulting in chemical entering of food and drinking water etc.

SOURCE OF AIR POLLUTION

- ***Automobiles:*** Co_2, Co, Pb, No_2, Black Smoke.
- ***Industries:*** So_2, No_2, Fly Ash, smoke, Hydrogen fluoride, HCl, Hydrogen sulphide, Ozone etc.
- ***Domestic Source:*** smoke, dust, So_2, No_2
- ***Miscellaneous:*** burning refuse, incinerator, pesticide, spraying, Natural source (fungi, bolds, bacteria etc.)

Air Pollutants and Health Effects

- Co: Carboxyhaemoglobin
- So_2: Acid rain
- Pb: Lead poisoning, decrease IQ level in young children
- Co_2: global warming and climate change
- Hydrocarbon: Eye damage
- Cadmium: Cancer
- So_2/H_2S: unpleasant odour, conjunctival irritation, mental and neurological damage.
- Ozone: ozone layer depletion
- Polynuclear Aerometric Hydrocarbon(pah): Lung cancer
- Particulate matters: COPD, respiratory problems.

Effect of Air Pollution

Health Aspect

Acute effect: ARI, Acute pneumonia, Acute bronchitis, immediate death by suffocation

Chronic effect: COPD, Lung cancer, Emphysema, Respiratory allergy etc.

Social and Economic aspect

Destruction of animal and plant life, corrosion of metals, damages to buildings, cost increase in cleaning and maintenance, aesthetic nuisance, reduction of visibility of town, damage of soil, damage of clothing.

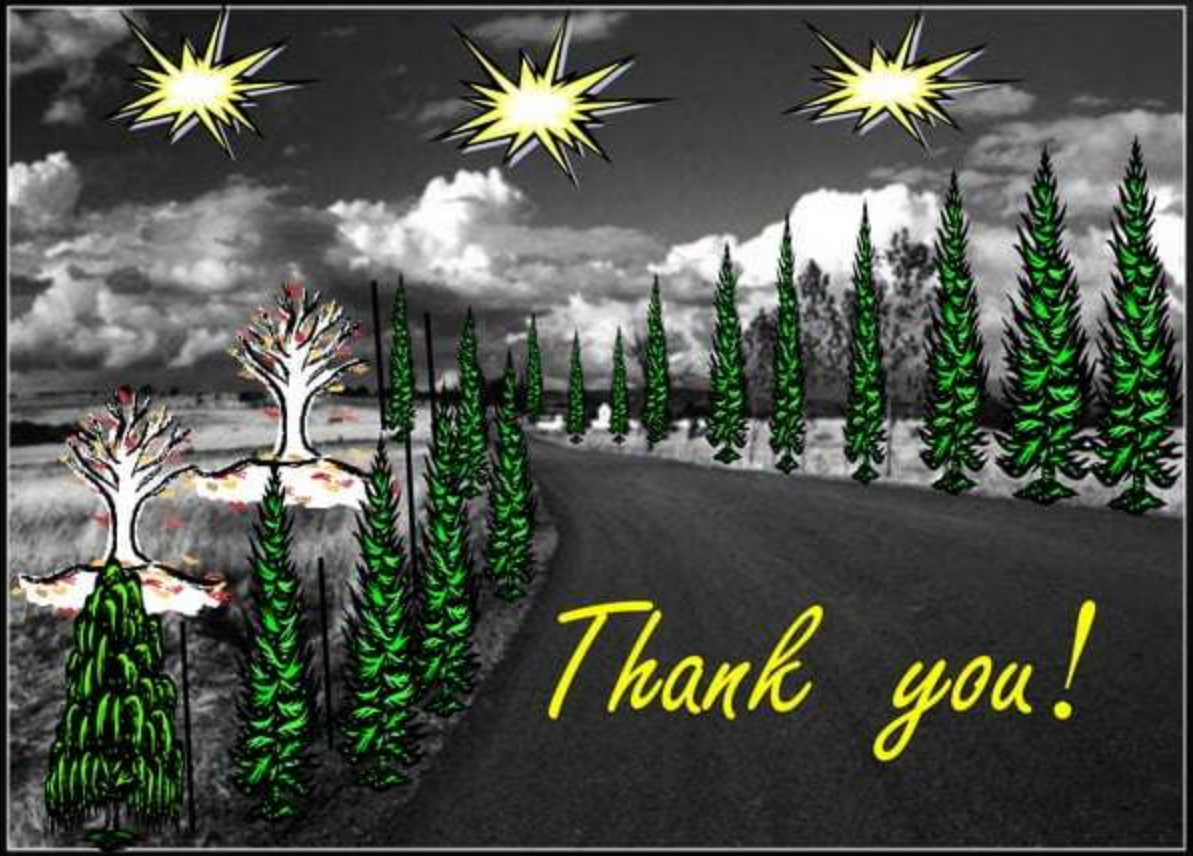
Prevention and Control of Air Pollution

WHO recommended procedure

1. ***Containment:*** Prevention of escape of toxic substance in atmosphere by enclosure, ventilation and air cleaning
2. ***Replacement:*** replacement of coal, firewood, lead petrol by new technology e.g. electricity, natural gases, central heating, solar power etc.
3. ***Dilution:*** self cleaning capacity of environment. E.g. establishment of greenbelt.

Prevention and Control of Air Pollution

4. ***Legislation:*** Formulation, implementation and monitoring of environmental act and regulation
5. ***International Action:*** WHO established an international network of laboratories for the monitoring and study of air pollution.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MEDICAL ENTOMOLOGY

- A study of the arthropods of medical importance is known as medical entomology. It is an important branch of preventive medicine.

- Some arthropods are beneficial as they help in fertilization of flowers and crops and some are harmful to human being as they are vector and reservoir of disease and also destroy the men's crops and foods.

ARTHROPODS-BORNE DISEASE

Arthropods	Disease transmitted
Mosquito	Malaria, Filaria, JE, Dengue fever, West Nile fever, yellow fever etc.
Housefly	Typhoid and paratyphoid fever, Diarrhoea, dysentery, cholera, Gastroenteritis, amoebiasis, helminthes, poliomyelitis, trachoma, conjunctivitis, anthrax etc.
Sandfly	Kala- azar, oriental sore, sandfly fever, Oraya fever etc.

ARTHROPODS-BORNE DISEASE

Arthropods	Disease transmitted
Tsetse fly	Sleeping sickness
Louse	Epidemic typhus, relapsing fever, trench fever, pediculosis etc.
Rat flea	Bubonic plague, epidemic typhus, chiggerosis, hymenolepsis diminuta etc.
Black fly	Onchocerciasis
Reduviid bug	Chagas disease
Itch-mite	Scabies

ARTHROPODS-BORNE DISEASE

Arthropods	Disease transmitted
Hard tick	Tick typhus, viral encephalitis, viral fevers, viral hemorrhagic fever, tularemia, tick paralysis, babesiosis etc.
Soft tick	Q fever, relapsing fever.
Trombiculid mite	Scrub typhus, reckettsial-pox.
Cyclops	Guinea worm disease, fish tape worm
Cockroaches	Enteric pathogens

Transmission of Arthropod Borne Disease

1. Direct contact: arthropods are directly transferred from man to man through direct contact. E.g. scabies and pediculosis.
2. Mechanical transmission: disease causing agents are transmitted mechanically by arthropods. E.g. transmission of diarrhoea, dysentery, cholera, typhoid, trachoma etc by housefly.

Transmission of Arthropod Borne Disease

3. Biological transmission: Disease agent multiplies or under goes some developmental change or with multiplication in the arthropod host.
   a. Propagative: disease agent undergoes no cyclic change, but multiplies in the body of vector e.g. plague bacilli in rat fleas.
   b. Cyclopropagative: disease agent undergoes cyclic change, and multiplies in the body of vector e.g. malaria parasite in anopheline mosquito.
   c. Cyclo-developmental: disease agent undergoes cyclic change, but does not multiplies in the body of arthropods e.g. filarial parasite in culex mosquito.

Principles of arthropods control

1. Environmental control
2. Chemical control
3. Biological control
4. Genetic control
5. Newer methods
6. Integrated approach

Principles of arthropods control

1. ***Environmental control:*** Elevation of breeding places, filling and drainage operation, carefully planned water management; provision of piped water supply; proper disposal of waste; proper house keeping etc.
2. ***Chemical control:*** Use of insecticides e.g. organochlorine, organophosphorus, carbamite groups compound to control vectors but yield the harmful effects to environment.

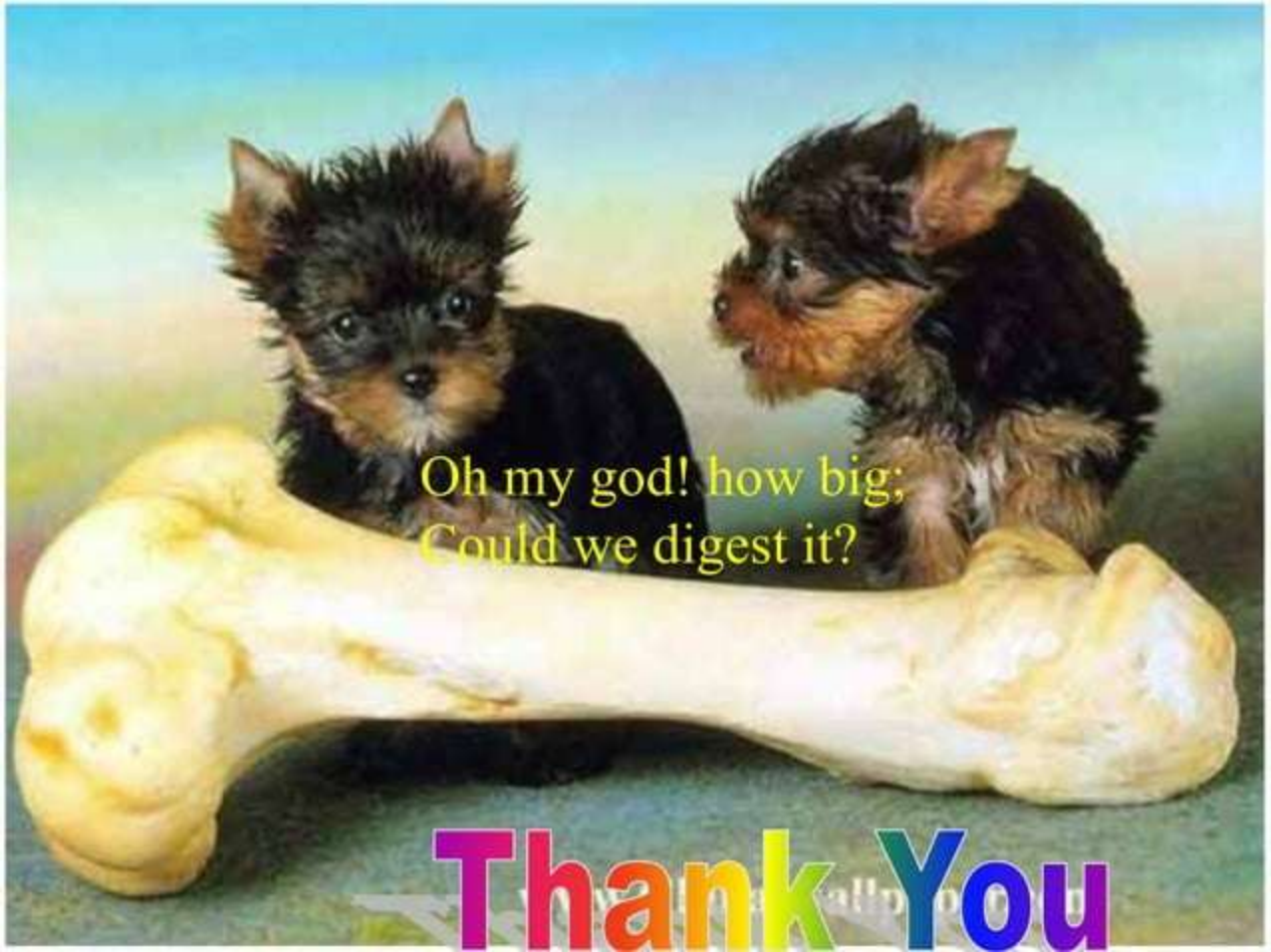
Principles of arthropods control

3. ***Biological control:*** control arthropods by using other organisms to minimize environmental pollution. E.g. use of larvivorous fish (Gambusia) to control malaria.
4. ***Genetic control:*** male sterile technique, cytoplasmic incompatibility and chromosomal translocations are found to be effective in small trials.

Principles of arthropods control

5. ***Newer methods:*** insect growth regulators, chemosterilants, sex attractants etc.

6. ***Integrated approach:*** combining two or more methods with the view to obtain maximum result with minimum effort and adverse consequences.


Oh my god! how big;
Could we digest it?
Thank You

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HUMAN EXCRETA DISPOSAL

PUBLIC HEALTH IMPORTANCE

- Human excreta is a important cause of environmental pollution and source of infection.
- Safe disposal of excreta is the responsibility of everyone.
- The hazards of improper disposal of excreta are:
  - Soil pollution
  - Water pollution
  - Food contamination
  - Propagation of flies

PUBLIC HEALTH IMPORTANCE

- The disease caused by improper disposal of human excreta disposal are:
  - Typhoid and Paratyphoid fever, Dysentery, Diarrhoea, Cholera, Round worm, Hook worm, Viral hepatitis and Other Intestinal infection.

METHODS OF EXCRETA DISPOSAL

1. Unsewered area
   1. Service type latrine (conservancy system)
   2. Non service (Sanitary Latrine)
      a. Bore hole latrine
      b. Dug well or pit latrine
      c. Water seal latrine
      d. Septic tank
      e. Acqa privy

METHODS OF EXCRETA DISPOSAL

2. Sewered area
   - Water carriage system and sewage treatment
     a. Primary treatment
        a. Screening
        b. Removal of grit
        c. Plane sedimentation
     b. Secondary treatment
        a. Trickling filters
        b. Activated sludge process
     c. Other methods : Sea outfall, river out fall, sewage farming, oxidation ponds.

SERVICE TYPE (NONSANITARY)

- It is unhygienic and unsocial method.
- It involves manual collection and removal of excreta to the disposal point.
- It is not a recommended and yield various harmful effects on human health.

NONSERVICE TYPE (SANITARY)

A sanitary latrine is one which fulfills the following criteria.

- Excreta should not contaminate the ground or surface water .
- Excreta should not pollute the soil.
- Excreta should not be accessible to the flies, rodents, animal and other vehicle of transmission.
- Excreta should not create nuisance due to odour or unsightly appearance.

BORE HOLE LATRINE

- First introduced by Rockefeller foundation in 1930's in campaign of hookworm control.
- The latrine consist of a circular hole of 30-40 cm (16 inch) diameter with 20 feet (6 meter) depth.
- A special equipment "Auger" is needed to make hole.
- The whole is lined with bamboo mating or earthen wire rings to prevent caving of soil.
- A concrete squatting plate is placed over the hole.
- A suitable in closure is put up to provide privacy.
- It is not very much in use today.

BORE HOLE LATRINE

DUG WELL OR PIT LATRINE

- It is an improvement over the borehole latrine .
- A circular pit about 75 cm (30 inch) in diameter and 3-3.5 meter (10-12 feet0) deep id dug into the ground for the reception of nightsoil.
- The pit may be lined with pottery or cement ring.
- A concrete squatting plate is placed at the top of the pit.
- A suitable in closure is put up to provide privacy.

DUG WELL OR PIT LATRINE

- It is easy to construct.
- The pit has longer life than bore hole latrine because of greater capacity.
- Deep will last for about five years for a family of 4-5 members.
- When pit is filled , a new pit is constructed.

DUG WELL OR PIT LATRINE

WATER SEAL LATRINE

- Water seal latrines are of two types
- Direct type: where the waterseal pan is placed directly over the pit.
- Indirect type: Where the pit is cited away from the squatting plate.
- Hand flushed waterseal latrine is used in rural areas where water closet or mechanical flushed latrine is used in urban areas,

WATER SEAL LATRINE

- Nightsoil is sealed by small depth of water contained in a bent pipe called the trap.
- The trap prevent the escape of odour and foul gases and there by eliminates the nuisance from smell.
- Once the latrine is flushed , nightsoil is no longer visible.

Essential features of Waterseal latrine

1. Location: Minimum 50 feet far from the source of water supply and no in flooding areas.
2. Squatting plate: Cement concrete with minimum 3 square with 5 cm thickness and at least 0.5 inch slope towards hole.
3. Pan: The Pan receive the nightsoil, urine and water. The length of pan is 42.5 cm (17 inch) and the wide of the front portion of the pan must be atleast 5 inch (12.5 cm).

Essential features of Waterseal latrine

Thank you.