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Environmental Health

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Chapter 1: Introduction

Basic concepts in Environmental Health

Objectives

At the end of this chapter, the students are expected to:

- ✓ Define the terms
- ✓ Describe the scientific basis for the practices of environmental health
- ✓ Describe the impact of humans upon the environment & vice versa
- ✓ Describe determinants of health.
- ✓ Describe the scope of Environmental Health
- ✓ List disciple have r/ship with Environmental Health

Cont..

Definition

Environment is the sum of all external influences and conditions, which affect health, life or growth.

- ✓ ‘… All that which is external to individual/human host.
- It can be divided into physical, biological, social cultural any or all of which can influence health status in populations.’ (WHO, 1995)
- Ex: Imagination the environment? See, breath air, temperature,house, factorise, Rivers, continents, univers etc.

Cont...

Health

- ✓ '...is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'(WHO, 1948)

'Health is only possible where resources are available to meet human needs and where the living and working environment is protected from:

- life-threatening and health threatening pollutants

Cont…

- pathogens
- physical hazards’(WHO, 1992a)

- “the ability to lead a socially and economically productive life. "holistic concept of health”

Environmental Health

✓ Is the prevention of diseases and promotion of health by eliminating or controlling the environmental factors, which form links in the chain of disease transmission

Cont...

- ‘... comprises those aspects of human health, including quality of life, that are determined by:
  - physical: noise, ionizing, non ionizing radiation
  - biological: insects, animals, disease causing organisms
  - social and psychosocial factors in the environment. Access to safe and sufficient health care
- It also, refers to the theory and practice of assessing, correcting, controlling, and preventing those factors in the environment that can potentially affect the health of present and future generations’ (WHO, 1993a)

Cont...

Health effect…

- ✓ '…is the specific damage to health that an environmental hazard can cause to an individual person.
- ✓ Often the same hazard can cause a range of different effects of different severity.' (Yassi et al., 2001)

The Scientific Basis for the Practices of Environmental Health

As a scientific discipline, Environmental health began with attempts to prevent and control communicable diseases, which, were believed to be caused by environmental factors such as:

- impure water and
- unhygienic disposal of sewage

Cont...

- ✓ It now embraces the total environment, from the:
  - individual dwelling to the entire biosphere,
  - seeks to maintain the well being of man not only physically but mentally and socially too
- Biosphere: is a thin shell that encapsulates the earth, is made up of the atmosphere, Lithosphere, and hydrosphere.
- Atmosphere: a mixture of gases extending outward from the surfaces of the earth.

Cont...

- Hydrosphere: Consists of oceans, the lakes and streams, and shallow ground water bodies that interflow with the surface water
- Lithosphere: the soil mantle that wraps the core of the earth.

✓ Life sustaining resources, air, food and water are withdrawn from the biosphere.

✓ It is also into the biosphere that waste products in gaseous, liquid, and solid forms are discharged.

Cont...

- From the beginning of time, the biosphere has received and assimilated the wastes generated by plant and animal life.
- Natural system have been ever active, dispersing smoke from forest fires, diluting animal wastes washed into streams and rivers, and converting debris of past generations of plant and animal life into soil rich enough to support future populations.

Cont...

- ✓ For every natural act of pollution, and for every undesirable alteration in the:
  - physical,
  - chemical or
  - biological characteristics of the environment, and also
- for every incident that eroded the quality of the immediate, or local environment there were natural actions that restored that quality.

Cont...

- Only the recent years has it become apparent that the sustaining and assimilative capacity of the biosphere, though tremendous, is not, after all, infinite.
- ✓ Though the system has operated for millions of years, it has begun to show signs of stress, primarily because of the impacts of humans upon the environment

Cont...

The impact of humans upon the environment

- ✓ In a natural state, earth's life forms live in equilibrium with their environment.
- ✓ The numbers and activities of each species are governed by the resources available to them.
- ✓ Species interaction is common, with the waste product of one species often forming the food supply of another. E.g. human waste is food for dog

Cont...

- ✓ Humans alone have the ability to gather resources from beyond their immediate surroundings and process those resources into different more versatile forms.
- These abilities have made it possible for human population to thrive and flourish beyond natural constrains.

Cont...

- ✓ But the natural and manufactured wastes generated are released into the biosphere by these increased numbers human beings have upset the natural equilibrium.
- ✓ Anthropogenic, or human induced, pollutants have overloaded the system.

The impacts of the environment upon humans

Populations are generally manage to ignore their impacts on the environment until they begin to become aware of the ill effects that a polluted environment can have upon their own health and well being.

Cont...

- ✓ Though stagnant river, smoky fires, and unsightly dumps were aesthetically displeasing to the citizens of over-crowded cities of earlier centuries,
- ✓ no attempt was made to reverse the negative impact of humans had on their environment until it become evident that heavily polluted:
  - water,
  - air

Cont...

- soil - could exert an equally negative impact on the health, the aesthetic and cultural pleasures, and the economic opportunities of humans.

Human-ecology interaction

Outcomes can be generalized as follows at macro level:

✓ Man can affect the environment:

- deforestation
- fire
- air pollution

Cont…

- noise pollution
- waste dumping,
- radiation pollution, etc.

This is due to human activities for land search, industrialization, urbanization, population explosion, migration, war, etc.

✓ Man can be affected by the environment:

- flooding,
- draught,
- famine,
- disease,

cont...

- earthquakes,
- lighting etc because of the various disturbances in the environment.

✓ Man can maintain environmentally good relationship:

- Afforestation,
- pollution reduction,
- disarmament,
- international conventions and
- legislations on environment, etc.
- **ASSIGNMENT 1. list and discuss international conventions and legislation on environment.**

Why environmental health matters?

Lack of access to clean water and sanitation

Some 3 in 10 people worldwide, or 2.1 billion, lack access to safe, readily available water at home, and 6 in 10, or 4.5 billion, lack safely managed sanitation, according to a new report by WHO and UNICEF in 2017

- Indoor air pollution

Indoor air pollution can be just as deadly. In 2012, an estimated 6.5 million deaths (11.6% of all global deaths) were associated with indoor and outdoor air pollution together.(WHO, 2016)

Cont...

- Vector born diseases
  - ✓Malaria
  - ✓Dengue and dengue hemorrhagic fever
  - ✓Filariasis
  - ✓Yellow fever (viral)
  - ✓Human African trypanosomiasis

Cont…

- Environmental health and poverty
- Poor people’s live in areas with the worst environmental conditions
- The burden of environmental disease falls more harshly on the poor…they have lower resistance to infection
- Poverty--- disease---loss of income---loss of jobs
- Other Global problems (write two global problem with its relation with environmental health)

Cont….

- Ambient air pollution and indoor air pollution: the health of 400-700 million people in the world is endanger due to indoor air pollution;
- Ozone depletion has raised the risk of skin cancer;
- Loss of biodiversity has raised the need of basified in many developing countries;

Determinants of health

1. Physical/environmental factors

Climate

- Tropical countries
  - ✓Warm, humid temperature, prevalence of rain

Cont….

- ✓Parasitic and infectious diseases are leading community health problems
- ✓inadequate food production

- Temperate climate
  - ✓Fewer parasitic and infectious disease and a more than adequate food supply, chronic non-communicable diseases are common problems

Production and use of non-renewable natural resource

Example fossil fuels

- ✓Non- renewable because it takes billions of years to produce them when compared with the rate of consumption

Cont...

- The consumption of fossil fuels produces 21.6 billion tons of Carbon dioxide per year which results in 10.56 to the atmosphere.
- This gas is responsible for the Global temperature increment (even though there are many scientific explanations for global temperature increment)

Cont...

Population Growth

- As population and demand for natural resources continue to grow, environmental limits will become increasingly apparent.
- As we humans exploit nature to meet present needs, we are destroying resources needed for the future
- Water shortages are expected to affect nearly 3 billion people in 2025, with sub-Saharan Africa worst affected

Cont...

Industrial development

- ✓ Positive impact
  - Added recourses to the community
- ✓ Negative impact
  - Environmental pollution
  - Occupational illnesses

2. Social and cultural factors

Arise from the interaction of individuals or groups within the community.

Cont...

- ✓ Prejudice of one specific ethnic group against the other can result in acts of violence and crime.

Religion

- ✓ Some limit the type of medical treatment their members may receive
- ✓ Some don’t permit immunization, HIV/AIDS medications; some never donate blood to the needy ones, etc.

Cont...

Social norms

Example… Alcohol consumption of **college students**; the normal expectation seems to be fan.

- Smoking
- Chewing chat

Socioeconomic status

- ✓ low socioeconomic status
- ✓ Have the poorest health and the most difficulty In gaining access to health care

Cont...

- ✓High socioeconomic status
- ✓Have family doctors

3. Individual behavior

Examples

- ✓If each occupant wear a safety belt, …
- ✓If an individual is immunized against a certain disease , the lower the disease will be spread and the fewer people will be exposed
- ✓Personal choices, social and physical environment can shape individuals behavior

Cont...

4. Biological factors

- ✓ Individuals genetic makeup
- ✓ Family history which may suggest risk for a disease
- ✓ Physical and mental health problems acquired during life
  - Aging, diet, physical activity, stress, alcohol and drug abuse, injury

Cont…

- Biological agents (infectious or toxins generated from them)

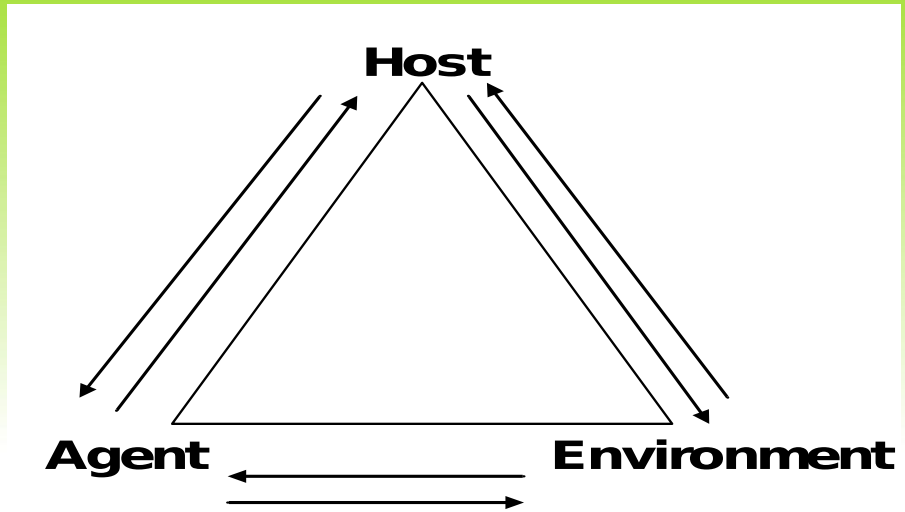
Major determinants of Health

- ✓ Agents- these are pathogens (disease causing microorganisms such as bacteria, viruses, etc.)
- ✓ Host- the animal that is exposed and infected by the pathogen, i.e. man.

Cont...

- ✓ Environment
  - It encompasses the water we drink, the food we eat, the air we breath
  - the environment affects people's health more strongly than any of the other determinants
- ✓ The interactions of these three conditions, as indicated in the following figure, make a person sick.

Cont...



- ✓ To stop the spread of communicable diseases, the chain can be broken by attacking the agent, protecting the host or changing the environment.

Cont...

- If we have to aim at the agents the most common practices are:
  - Sterilization (the process of killing all microorganisms including spores)
  - Disinfection (the application of chemicals to materials, which come in to contact with or are ingested by humans, for the purpose of killing pathogenic microorganisms)

Cont...

- ✓ If we approach to protect the host:
  - Personal hygiene
  - Immunization
  - Nutrition
  - Isolation
- ✓ If the approach to break the disease chain is aimed at the environment:
  - Environmental manipulation

Cont...

- For health professional like you needs to understand and gets overview of the components and a few basic principles of environmental health as these would help:
  - in assessing the health risks of exposure to potentially adverse environmental conditions.

Scope of Environmental Health

- Waste disposal: Proper excreta disposal & liquid waste management, Proper application of storage, collection, disposal: Waste recycling and generation analysis
- Housing sanitation: Physiological needs, protection against disease and accidents, psychological, and social comforts in residential and recreational areas

Cont...

- Water supply: Adequacy, safety for domestic, drinking, and recreational use
- Food sanitation/ hygiene: Food safety and wholesomeness in its production, storage, preparation, distribution, sale, until consumption
- Arthropod and Rodent control: Control of disease transmitting and harmful arthropods and animals

Cont...

- Atmospheric conditions to ensure that the external atmosphere is free from harmful elements and that the internal conditions of workshops, houses, etc. are suitable for the occupations undertaken in them
- Occupational health /hygiene: Occupational health service, sanitation, safety in working settings
- Hygiene education
- Urban and regional planning

Cont...

- Environmental health aspects of air, sea or land transport
- Public recreation and tourism

Historical Background of EH

- ✓ “Sanitation is a way of life” Frequently, through-out history,
- ✓ The earliest public health measures were concerned with environmental matters

Cont…

- ✓ Moses laws have dictates concerning sanitation
- ✓ The supply of water and the removal of wastes have been critical problems for aggregations of people
- ✓ Minions (300-1500 B.C.), and the Egyptians (1000 B.C.) built drainage systems
- ✓ The Grecians were concerned about personal hygiene and cleanliness

Cont...

- The Romans built aqueducts and drainage systems, which were marvels

✓ Terrible pandemics swept through the cities of Europe, decimating(kill or destroy) the population

  ✓ Such diseases as cholera and bubonic plagues

✓ After killing some 13 million people in china and India, the "Black Death" (bubonic plague), descended to Egypt in the1340's where 10,000-15,000 deaths took place daily

Cont...

- ✓ As the plague progressed through Europe, at least 100,000 died in London alone
- ✓ Half the population of Europe was wiped out in which sixty million people died. In contrast, 35 million people died during World War II
- ✓ Plague still exists in many parts of the world

Cont...

- ✓ Before science established the cause of disease people, at times, instinctively avoided circumstances suspected of causing disease
- ✓ Thus an epidemic of cholera and typhoid in London in 1854 was terminated by the simple expedient of removing the handle to a pump on a well located adjacent to a sewer.

Cont...

- ✓ The term “malaria” was applied to a disease thought to be associated with “bad air”, which was equated to be night air.
- ✓ We now know, of course, that the female anopheles mosquito attacks people in the evening and transmits the causative organism

Related Disciplines

Medical Doctors/Surgeons	Dentists	Biostatisticians
Nutritionists	Psychologists/ Psychiatrists	Nurses
Epidemiologist	Social Workers	Clinicians
Toxicologists	Pharmacists	Biologists/ Microbiologists
Physiologists	Mathematicia	Educators

Related Disciplines

Engineers	Risk Assessors	Public Health Educators
Health Service Administrators	Chemists	Behavioral Psychologists
Physicists	Ecologist	Zoologist

THANK YOU

Question or suggestion!!!!!

Chapter 2: Community water supply

Learning Objectives

At the end of this chapter, the students are expected to:

- ✓ Discuss the special characteristics of water
- ✓ Describe the uses, impurities and adverse effects of water
- ✓ Discuss the disease associated to water
- ✓ Be aware of types of water sources
- ✓ Criteria in quality of safe water
- ✓ Discuss the water treatment

Introduction

- ✓ Water, which is odorless, tasteless, transparent liquid
- ✓ Is colorless in small amounts but exhibits a bluish tinge in large quantities
- ✓ It is the most familiar and abundant liquid on earth
- ✓ In solid form (ice) and liquid form it covers:
  - ➢ about 75% of the earth's surface, were about:-

Cont...

- ✓Saltwater oceans hold 97.40% of surface water
- ✓1.6% of water below ground in aquifers and 0.001% in the air as vapor, clouds and precipitation.
- ✓glaciers and polar ice caps 1.98%, and
- ✓other land surface water such as rivers and lakes 0.62%.

Special characteristics of water

- ✓ Water has interesting thermal properties
- ✓ When heated from 0°C, its melting point, to 4°C,
- ✓ it contracts and becomes denser; most other substances expand and become less dense when heated
- ✓ Conversely, when water is cooled in this temperature range, it expands
- ✓ It expands greatly as it freezes; as a consequence, ice is less dense than water and floats on it

Drinking water: importance(uses)

Multiple/ Holistic (Water is life)

- ✓ Physiological needs: drinking/ 2-3 liters/day needs
- ✓ The average adult body is made up of 50%-75%
- ✓ Muscles are about 75% water by weight
- ✓ Fat tissues are about 25%
- ✓ Bones are about 20%, Brain is about 90%
- ✓ 60% of red blood cells, and over half of most other tissues
- ✓ Most foods contain water Ex. Milk 90%, Fish 80%
- ✓ Survival without water is very hard

Cont…

- ✓ Domestic cleaning, washing
- ✓ Social use: swimming, recreational
- ✓ Cultural/ Spiritual values: “Tebel”, “Timket” ,praying
- ✓ Economical: agriculture, transportation,
- ✓ power production, industrial use,
- ✓ Fish and wild life maintenance etc,
- ✓ **Water is politics e.g. red sea**

ASSIGNMENT 2. discuss how water became politics? When and where first issue takes water as politics raised? Illustrate with example.

Cont...

Impurities

- ✓ **Water is not absolutely pure in nature**
- ✓ It gathers impurities as it goes through its natural cycle
- ✓ It’s possible to categorize impurity based on their chemical properties and their solubility’s

Cont…

1.Organic and inorganic impurities

- ✓ The impurities found from the earth are called inorganic (non-living) and
- ✓ Those from the growth and decay of animals and vegetable matters are called organic. (Chemical properties).

2. Suspended and dissolved impurities

Based on their solubility's impurities of water are found in two forms:

Cont…

2. 1.Suspended impurities, including colloids, microorganisms, clay, slit, pesticides, algae etc

- ✓ Can cause taste, color and turbidity

2.2.Dissolved impurities, including gases, minerals.

- ✓ Gases such as Co_2, O_2, H_2S etc.
- Co_2 and H_2s may cause acidity in water
- H_2s imparts a **bad odor** to the water
- ✓ *Minerals*: get access through percolation
- ✓ E.g. Ca, Mg, Na, K and others (fluorides, Nitrate)

Physicochemical properties

Adverse effect

1. Turbidity

Significance

- ✓ *Aesthetic Value:* The public have the right to demand turbid free water
- ✓ *Filterability:* Filtration of water is rendered more difficult and costly when turbidity increases

Cont…

2. **Color**

- Apparent color: Suspended solids
- True color: Dissolved solids

Significance

- *Aesthetic value:-* People tends to choose clear non- colored water of otherwise poorer quality

3. Hardness

- ✓ Temporary hardness (Ca & Mg hardness)
- ✓ Permanent hardness (Carbonate & bicarbonate hardness)

Cont...

- **Significance**
  - ✓ **Soap consumption** of hard water represents an economic loss to the water user
  - ✓ **Scale formation** on boiling

4. **Acidity**: Base-neutralizing capacity
   - ✓ Carbon dioxide acidity
   - ✓ Mineral acidity

Significance

- ✓ Corrosive characteristics and the expense involved in removing/controlling the corrosive producing substance

Cont...

- ✓ CO_2
  - Found in beverage in excess of any concentration known in natural water. And no deleterious effect have been recognized

- ✓ Mineral
- Unpalatable to drink but problems related to human consumption is non-existence

5. **Alkalinity**: Acid-neutralizing capacity

Significance

- ✓ In large quantities, alkalinity imparts a bitter taste to water

Cont...

- ✓ The resultant precipitate can foul pipes and other water systems appurtenances

6. **Excess or shortage of chemical constituents**

- ✓ Elements occur due to **geological formation** or
  - water gets contaminated through discharges or infiltration of organic compounds

Cont...

- pesticides used in agriculture

E.g. Fluoride:

- **Excess dental fluorosis (mottled teeth)**
- Shortage dental caries (tooth decaying)

Excess Nitrate -Methemoglobinemia (blue babies syndrome)

Water quality

- ✓ The importance of water quality
  - Safe water is a precondition for health and development and a basic human right, yet it is still denied to hundreds of millions of people throughout the developing world.

- Despite continuing efforts by governments, civil society and the international community, Globally, at least 2 billion people use a drinking water source contaminated with faeces.

cont…

Ethiopian condition access to improved drinking water sources:

- ✓ 53.7% coverage [EDHS 2016, CSA]
- ✓ 34.4%: piped water;
- ✓ 19.1%: protected ground water source (wells, springs)
- ✓ 38% for improved water supply (98% for urban areas and 26% for rural areas)
- ✓ 12% for improved sanitation (29% in urban areas, 8% in rural areas

Q? How do you see this percentage?

Problems associated with safe water supply

- ✓ Water loss= 1% thirst; 5% hallucinations; 15% death
- ✓ ~80% of infectious diseases
- ✓ 5M people, mostly children, die each year from water-borne diseases
- ✓ Lost work days
- ✓ Missed educational opportunities
- ✓ Healthcare costs
- ✓ Draining of family resources

Cont…

- It is increasingly clear that many of the existing improved sources in developing countries like as Ethiopia do not provide water of adequate quality for domestic purposes.
  - A well-known example of this is the extensive contamination of tube wells with naturally occurring arsenic in Asia.

Cont…

- Occur in ground water from arseniferous belt
- Industrial waste, agricultural insecticide
- High arsenic causes various type of dermatological lesions, muscular weakness, paralysis of lower limbs, can also cause skin and lung cancer
- Acceptable limit – 0.01 mg / l



Cont…

- ✓ an increasing number of sources and systems used by people for **drinking and cooking** water are not adequately protected from fecal contamination.
- ✓ This is due to a variety of factors, including:
  - Deforestation, population pressure, climate change, urbanization and
  - inadequate construction, operation and maintenance of water systems.

Cont…

Water should be free of:

- **Drinking water should be free of microorganisms, which are injurious to health**:
  - It is not stated in guidelines "absolutely free". Because:
  1. It is not possible to have zero microbes in a large volume of water
  2. It is not necessary
     - In general a person will not become ill when one micro-organism is ingested

Cont…

- ✓ Whether ingestion of microorganisms result in disease or not depends on:
  - **How virulent** (ill natured) the microorganism is;
  - **How many microorganisms are ingested**; Infective dose (1, 100, 1000, … depends on the organism of concern)
  - **How resistant is the consumer**.
- ✓ Unfortunately N, V and R are very difficult to determine.
- ✓ So in practice the policy is to keep/bring the concentration as low as feasible.

Cont…

What is the routine practice?

- ✓Monitoring the presence of specific pathogenic organisms in water is impracticable and indeed unnecessary for daily routine control purposes.
- ➢Thus, **indicator organism are used to indicate fecal pollution of water sources.**
- ➢an indicator organism is one whose presence indicates the presence of pathogens in the environment;

Cont…

- these organisms must be easily isolated & quantified by simple bacteriological methods.
- It is accepted that whenever pathogenic microbes like those causing typhoid or paratyphoid, gain access to water supply through excretal pollution, they are always accompanied by natural organisms that inhibit the intestine (coliforms).

Cont…

- ✓ There are **two principle groups of Coliform**:
  - Total Coliform group that includes faecal Coliform as well. Bacteria of the Coliform group are present e.g. in large numbers in the soil
  - Fecal Coliform (mainly comprising the bacterium E.coli);

So, E.coli is a more specific indicator than the total coliform group.

Cont…

What is the guideline value for E coli? ***E.coli should be absent in 100 ml sample***

Reasons :

- Fecally polluted water is responsible for spreading enteric diseases;

Cont…

Risk classification of E. Coli for rural water supplies

Count per 100 ml	Risk category
0	In conformity with WHO guidelines
1-10	Low risk
11-100	Intermediate risk
101-1000	high risk
>1000	Very high risk

Water Requirement (demand)

- The amount of water a person needs each day is determined by a number of factors
- **Factors influencing the amount of water used are**: Cultural habits
  - Socio-economic status and standard of living
  - Hygiene awareness
  - Productive uses
  - The charges for water

Cont…

  - The quality of the water as experienced by the users
  - Religion
- Depending on climate and workload, the human body needs from 3-10 liters of water per day for normal functioning.
- Part of this water may be derived from food
- ***The water demand of the community depends on*:**
  - Climate
  - Standard of living
  - Availability and method of distribution

Cont…

The per capita per day usage of water for domestic purposes (via a house connection) for countries in southern Asia.

Purpose	Quantity (l/c/d)
Drinking	5
Cooking	3
Sanitary purposes	18
Bathing	20
Washing	15
Clothes washing	20
Total (excluding water loss and wastage)	81

Quality of Water

- ✓ Any **new or untreated sources** of water should be examined for quality before expensive development is undertaken
- ✓ Good quality water for human use should be colorless and be free of:
  - harmful bacteria
  - **sediment**,
  - objectionable minerals,
  - Tastes
  - **odor**

Cont..

- ✓ Therefore, the following tests should be performed before developing potential water supply sources and
- ✓ **After development at regular intervals to check subsequent pollution or contamination**
  - Testing for contamination
  - Testing for minerals
  - Testing for sediments, color, taste, and odor.
  - Testing for Acidity and alkalinity

Types of water quality examination

The assessment of potability of drinking-water is usually determined by: a combination of results obtained from laboratory analysis and from sanitary surveys of the water source

1, **Physical examination**: to determine aesthetic quality

2. **Chemical examination**: To test for chemicals which affect the water quality and/or which are indicative of pollution

3. **Bacteriological examination**: To test for the presence of bacterial indicators of pollution & hence safety for consumption,

Diseases associated with water

- Unfortunately not all water sources help man to survive
- Drinking water – contaminated by pathogens causes numerous diseases and untimely deaths
- **About 80% of all diseases** and one-third of the deaths in the developing countries are associated with unsafe water

Cont...

- In countries like Ethiopia, since large majorities of the people get their water supply from unprotected sources, water borne diseases are not a thing of the past but one of the most significant public health problems of the present.
- water from contaminated sources cause numerous disease and untimely deaths

Cont...

- ✓ The fact that man needs water and can not survive without it forces him to use it even for drinking purposes from any sources, clean or contaminated.
- ✓ This leads for many people to surfer or die form water- borne diseases

Cont...

Factors affecting transmission of diseases

- ✓ Transmission of water borne diseases is influenced by

1. **Latency**: is the period of time between excretion of a pathogens and it becoming infective to new host.
2. **Persistence**: is measured by the length of time that a pathogens remain viable in the environment out side a human host.

Cont...

3. **Infective dose of the pathogens**: is the number of organisms that must be ingested to result in disease.

Broadly it classified in to four:

1. **Water- Borne Disease**:- Due to ingestion of faecally contaminated water

✓ Diseases like:
- cholera

Cont...

- typhoid fever
- bacillary dysentery
- infectious hepatitis
- amoebiasis are some examples.

2. **Water washed disease/ water-shortage disease**

Due to lack of adequate supply of water and poor sanitation (personal hygiene)

Cont…

- ✓ Diseases like:
  - eye infections (trachoma, bacterial, conjunctivitis),
  - Skin infections (scabies, ring worms),
  - Louse – borne diseases (RF) are some examples.

3. **Water- Related Vector Borne Disease:-** Water serves as development and breeding site of insects (water is essential for completion of the life cycles of the vectors)

Cont...

- ✓ Diseases like:
  - malaria,
  - yellow fever
  - onchocerciasis
  - sleeping sickness are some examples.

4. **Water Based Disease/ Water Impounding**

Disease:- Caused by infectious agent come in contact with water or ingestion of contaminated H2O

Examples: Schistosomiasis (biliharzia),

Dracunculasis (Guinea worm) etc

Drinking water: Diseases transmission and control

Transmission route	Disease	Cause	Control
Water borne	- Cholera - Typhoid	Drinking faecal material	Improve water quality
Water washed	Skin and eye infections - Louse borne typhus	Lack of water for proper hygiene	Increase water, accessibility and reliability - Improve hygiene practices
Water based	Schistosomiasis (penetrating skin) - Guinea worm (ingested)	Pathogen requires aquatic env't for part of life cycle - Eating insufficiently cooked aquatic species	Control snail populations - Reduce surface water contamination
Water related insect vectors	Sleeping sickness - Filariasis - malaria	Insects that bite or breed near water	Destroy breeding sites - Use mosquito netting

Planning of community water supply should be considered:

1) Microbiological safety;

2) Removal of excessive and undesired chemicals;

3) Addition of essential chemicals;

4) Removal of impurities that interfere with water color, taste, transparency, and odor;

- ✓ **The quantity: adequate and continuous**
  - Convenience: ideally be piped, accessible, reasonably cheap (affordable)

Water and its relationship to Environmental Health

- ✓ **It is impossible to have a sanitary environment without water**. Water is important in promoting personal hygiene and in cleaning the surrounding
- ✓ Health can not be maintained without adequate and wholesome water supply.
- ✓ The provision of a good, clean, plentiful water supply in a community is therefore of vital importance in public health services

Source of water

Ground water –well & springs

- ✓ It is a portion of the rainfall water which has percolated into the earth
- ✓ It can be a **long-term 'reservoir'** of the natural water cycle, as opposed to short-term water reservoirs like the atmosphere and **fresh surface water which is about 0.62%of the entire world's water supply**

Cont...

Advantages and disadvantages of Ground water

- ✓ Advantages
  - **Safer than surface water:** likely to free from contamination and pollution
  - Dependable year rounds
  - It is **Cheaper** (more or less doesn't need treatment plant if properly protected)
  - **Proximity to users**

Cont...

- ✓ Disadvantages
  - May contain excessive dissolved minerals
  - May need pumping
  - Once contaminated, ground water is difficult, if not impossible, to restore.

Cont...

Development of ground water:

- ✓ Factors to be considered during the development of ground water

1. Nature of the aquifer : The water-bearing capacity of the geological formation (Soil or Rock)
2. The hydraulic gradient: As ground water flows downwards in an aquifer, its upper surface slopes in the direction of flow
3. **Depth of the water table**

Cont...

Q: Dose it has any importance in prevention of ground water pollution or contamination?

Q: Affordability: Constraction (material, money)

Material used to draw Water (pump/bucket & rope)

Q: Pressure/amount of water

4. Distance from the source of the contamination

Prevention of contamination of well

✓ Sitting of well

- It should be sited on a higher level than the sources of contaminants-privies, cesspools...

Cont...

- The minimum distance between the well and the source of contaminant should not be less than **15m** (50 ft)

✓ Protection of the well

- **Casing**: should be made water proof by cementing from the top of the well down to a minimum depth of 3m

Cont...

- **Cover**: to prevent dust, insects, small animals, etc, from falling in to the well
- **Diversion ditch**
- **Sanitary bucket and rope**: if pump is not installed
- **Fencing**: The immediate area of the well should preferably by fenced to keep animals away

Cont...

Prevention of contamination of a spring:

- ✓ Sitting of a spring:
  - A complete, extremely careful and detail investigation/sanitary survey should be carried out
- ✓ Protection of spring
  - Construction of concrete waterproof protection box

Cont...

- Construction of collection box to ensure adequacy
- Intake and overflow pipe should be screened,
- A diversion ditch with a radius of 10 to 15 meters should be made around the protection box
- If possible the area surrounding the spring should be fenced

Surface water

- ✓ It is liable for contamination because pollutants can enter waterways by a number of different routes
- ❖ **Source of pollutant for surface water**
- ✓ **Point source**:
- Pollutants which enter a water way from a specific point through a pipe, ditch, culvert etc. e.g. sewage treatment plants, industrial discharges.

Cont...

- Although relatively easy to collect and treat, point sources have been the most conspicuous violators of water quality

✓ **Non Point sources/Multiple source**:

- Pollutants, which run off or seep in to waterways from broad areas of land rather than entering the water through a discrete pipe or conduit
- These are what are actually considered significant contributors to water contamination

Cont...

- ✓ They result primary from a variety of human land use practices and include:
  - **Soil erosion**
  - Construction activities
  - Animal feedlot runoff
  - **Pesticides and fertilizers run off**
  - **Urban street runoff**
  - Fallout of airborne pollutants

Drinking water supply surveillance: Safeguarding the quality of drinking water

Methods used:

1. Sanitary surveillance: system integrity; source of contamination
2. Laboratory surveillance: quality assurance
3. Epidemiological: rapid method; association of disease with drinking water

Sanitary and Epidemiological: surveillance

- The role of Public health manager in drinking water supply

✓ Initiating drinking water development (Small and large scale)

✓ M & E: Source quality assurance

✓ Water supply-line quality assurance

✓ Epidemic investigation Vs Water?

✓ Developing small scale water supply development

✓ Enhancing community participation: planning, implementation, use, M & E)

✓ Hygiene Education

Laboratory surveillance

To assure the quality in Water treatment

- ✓ Objectives of water treatment to make water **safe** for biological, physical, chemical and radiological parameters.

Treatment of water can be conducted

- ✓ At small scale level (home made)
- ✓ Large scale level (municipal water Rx)

Water treatment

1. Small scale water Rx

Small-scale treatment of water in:

- ✓ Emergency situations,
- ✓ temporary settlement areas,
- ✓ at household level and
- ✓ in areas where the municipality is not well organized is very important to reduce the problem of water borne disease through the utilization of different methods of water treatment.

Cont...

Treatment of household water supplies may be effected by the following methods, **used singly or in combination**, depending on the reliability of each method.

1. Boiling
2. Filtration
3. Solar disinfection
4. Chemical disinfection and
5. Households Water Storage

Emergence chlorination

WHO endorses disinfection of drinking water

- ✓ in emergency situations drinking water should be disinfected in all cases where
  - population size
  - lack of sanitary facilities, or health information suggest a significant risk of water-borne disease

- ✓ The most common method in emergencies is chlorination.

Water **disinfection** means the removal, deactivation or killing of pathogenic microorganisms.

.

cont…

Important advantages of chlorine disinfection are that

- ✓ It is **simple to dose and to measure**, and
- ✓ It leaves a **residual disinfection** capacity in the treated water, safeguarding against contamination in the home
- ✓ chlorine compounds available in solid or liquid form are most often used, as these are simple to store and handle.

How to prepare stock solutions?

- Health professionals can prepare the stock solutions from any chlorine-based product using the following formula.

$$Wp = \frac{Vw \times Cstock}{Cp \times 10}$$

Cont…

Where:

- **V_{water}** = Volume of stock solution will be prepared, in liters
- **C_{stock}** = concentration of stock solution intended (if as suggested, it is intended a 5000mg/l concentration, then the value for C_{stock} should be = 5000)
- **$C_{product}$** = Chlorine concentration in the product as specified by the manufacturer (in the formula, only the number should be placed, for example 65 when the chlorine concentration in the products is 65%
- **10** = Factor in order that the result be given in grams of the product
- **$W_{product}$** = Weight (in grams) of product to dissolve

Cont…

- Example 1. A well is 2 meters in diameter and contains water to a depth of 2 meters; it is desired to chlorinate the water in this well with 2mg/L of 40 % calcium hypochlorite.

  Calculate:

  A. The volume of water in the well

  B. The volume of calcium hypochlorite

  Solution: First find the volume of the water in the well using the formula

Cont…

$V = \pi r^2 h$

$V = (1^2)\ 3.14 \times 2m$

$V = 6.28 m^3$

V= 6280 liter

1 liter of water needs 2 mg/l of 100% Cl_2. Therefore 6280 liter of water needs

$$\frac{6280 \times 2 \times 100}{1000 \times 40} = \textbf{31.4gms}$$

31.4 gm of 40% calcium hypochlorite is needed

cont...

- Example 2. a new well was constructed and properly protected in your home and its 4m in diameters, level of water is 2m, should be disinfected with 10 mg/L of chlorine before it is passed for community use; it is desired to chlorinate the water in this well with sodium hypochlorite solution of 5% was employed for disinfection.

Calculate

- The volume of water in the well
- The volume of bara kina

Cont...

2. Large scale water Rx

The treatment of drinking water by municipal water systems involves key steps. These are:

1.Raw-water intake

- Surface water can be taken from streams, rivers, lakes or irrigation canals

2. Preliminary unit operations (e.g. screening),

✓Screening and Straining: The first stage in preliminary treatment usually involves a simple **screening or straining operation to remove large solids**.

Cont…

3. Aeration
   - ✓ Aeration is the treatment process whereby water is brought into intimate contact with air.

   Purpose:
   - Increasing the oxygen content,
   - Reducing the carbon dioxide content, and
   - Removing **H_2S, CH_4** and various volatile organic compounds responsible for **bad taste and odor**.
   - Removing of dissolved minerals (iron and manganese)

Cont...

It is widely used for the treatment of **groundwater having too high an iron and manganese content**

4. Coagulation and flocculation (Al_2SO4//Alum)

- ✓ Sometimes the insoluble particles are too small to settle out quickly enough to use sedimentation alone
- ✓ During this time, two processes, known as **coagulation and flocculation, are used to create** larger particles that will settle quickly to the bottom

Cont...

5. Sedimentation

- ✓ Raw water contains various suspended matters such as reduced iron and manganese, bacteria and organic colloids as impurities.
- ✓ These can be **allowed to settle and removed** when the water stands still.

6. Filtration is a physical, chemical, and biological process for **separating suspended impurities** from water by passage through porous media

Cont...

- Two general types of filters are used in water treatment:
  - **Slow sand filter and Rapid sand filter**

    (write filtration in conventional water treatment)

7. Disinfection means the destruction, or at least the complete inactivation, of harmful micro-organisms present in the water.

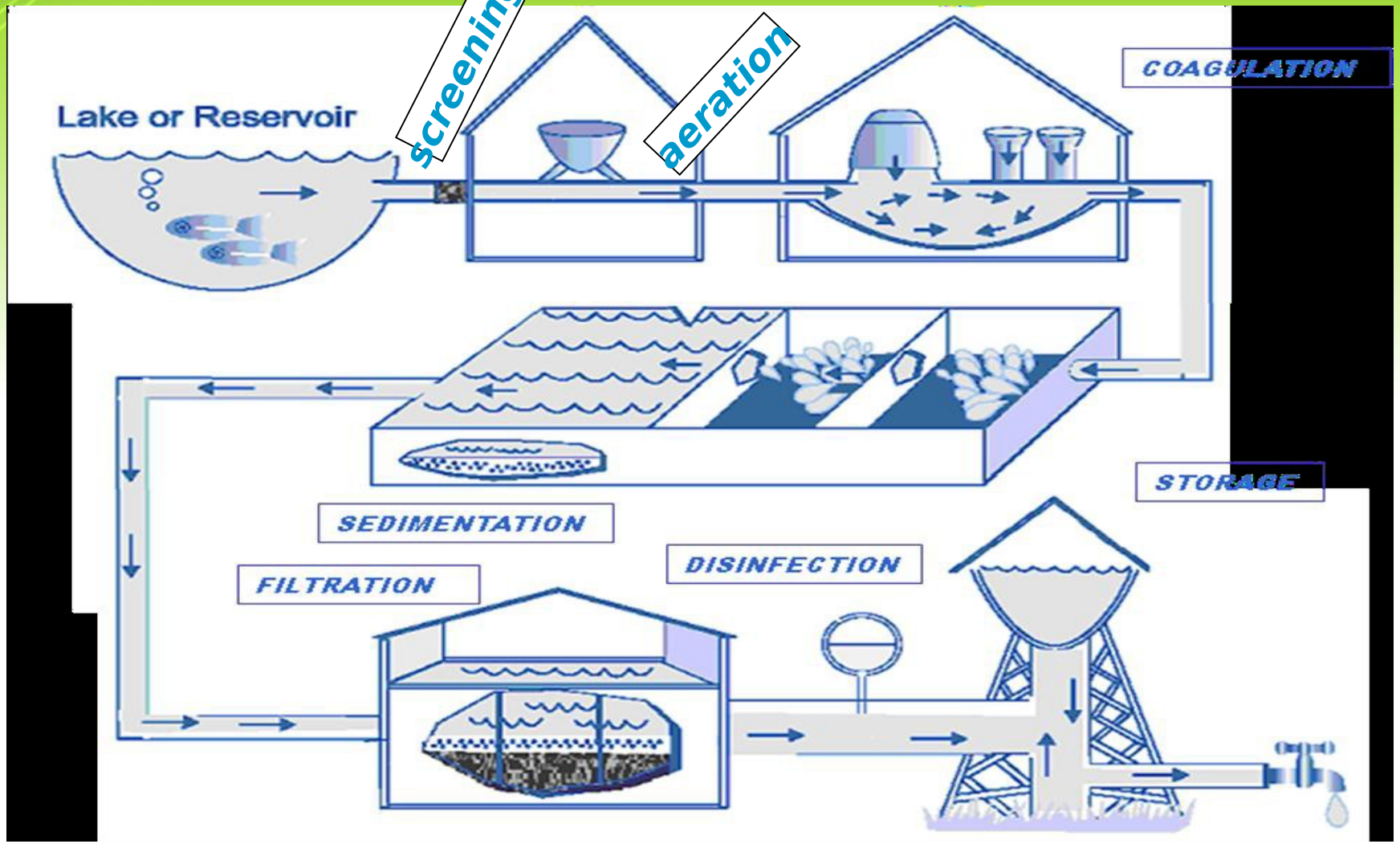
Cont...

- ✓ It is considered the last barrier in water treatment and in cases where no other methods of treatment are available,
- ✓ It may be resorted to as a **single treatment against bacterial contamination of drinking water.**

8. Distribution

- ✓ Supply to the consumers.

Cont...


screening
aeration
COAGULATION
Lake or Reservoir
STORAGE
SEDIMENTATION
DISINFECTION
FILTRATION

Some relevant water quality parameters

- ✓ Temperature
- ✓ Turbidity Odors & tastes
- ✓ Color
- ✓ pH
- ✓ Alkalinity & acidity
- ✓ Chlorides
- ✓ Nitrogen compounds (organic N, ammonia N, nitrite N, nitrate N)
- ✓ Hardness
- ✓ Fluorides
- ✓ Iron & manganese
- ✓ Sulfates
- ✓ Residual Chlorine
- ✓ TDS
- ✓ DO
- ✓ BOD
- ✓ COD
- ✓ Coliforms

Measuring Community drinking water Supply

Community water M & E should consider :

- ✓ **Availability** : present at home any time
- ✓ **Safety**: biological, physical, chemical
- ✓ **Adequateness**: How much water per day/c? based on 20 l/c/d for urban 0.5 km radius Vs 15 l/cl/d for rural at 1 km radius

Cont.....

- **Accessibility**: distance, time from water source:<0.5km for urban Vs 1km for rural within <30minute.
- **Coverage**: define
- **Continuity** : no interruption of the water source providing safe water

THANK You
bishaan
lubbuu dha
wuha hiwot
nw

Chapter 3: Community waste disposal

Learning Objectives

At the end of this chapter, the students are expected to:

- ✓ Define solid & liquid waste
- ✓ Be aware of problems associated with solid wastes
- ✓ Discuss about solid waste management
- ✓ Be aware of solid waste management hierarchy
- ✓ Discuss about HCWM
- ✓ Be aware of safe management practice of HCW
- ✓ Know the treatment & disposal options of HCW
- ✓ Be aware of public health importance of LW
- ✓ Understand excreta born disease & disposal methods

Introduction

Definition of Waste

- ✓ Waste is **anything that is normally discarded as useless or unwanted**.
- ✓ Wastes are mainly results of human activities including:
  - ✓ *physiological* (as feaces and urine) and
  - ✓ daily activities performed for survival and development of the society.

Cont...

- ✓ The problem of wastes is becoming a **global concern.**
- ✓ Wastes may have effects on house-hold levels, at a community level, at a national level and may also have cross border problems, becoming concern of the international community.
- ✓ This chapter will briefly discuss the public health aspects of community wastes

Group of wastes

- ✓ Wastes can be grouped into four large classes:

a) Solid wastes

b) Liquid wastes

c) Gaseous or particulate wastes and

d) Energy wastes

- ✓ In this course we will look to some details of the solid and liquid wastes

Solid wastes

- These are materials which are solid in nature which arise from:
  - various human activities and
  - which are normally discarded as useless or unwanted.
- In Ethiopia **litters or rubbish** are thrown indiscriminately every where.
- Such acts have **aesthetic**, **health** and **economic impacts**.

Cont…

- ✓ Solid waste production started **when people begun to process their food.**

Sources of Solid Waste

- ✓ Domestic
- ✓ Industrial
- ✓ Commercial
- ✓ Agricultural
- ✓ Construction
- ✓ Mining

Problems Associated with Solid wastes

- If solid wastes are not managed properly, there are many negative impacts that may result.
  - ✓ Causing **blockages in drains** which result in flooding and unsanitary conditions.
  - ✓ **Flies breed** in some constituents of sw
  - ✓ **Mosquitoes breed** in blocked drains and in rainwater that is retained in discarded cans, tires and other objects.

Cont…

- ✓ Rats **find shelter** and food in waste dumps
- ✓ The **open burning** of waste causes **air pollution**
- ✓ Uncollected waste degrades the urban environment
- ✓ Aesthetic nuisance in terms of smell and appearance
- ✓ **Methane is much more effective than CO_2** as a **greenhouse gas**, leading to climate change.

Cont...

- ✓ Problems related to waste production were further complicated when the western society manufactured disposable items
- ✓ The problem associated with waste becomes complex due to:
  - **Population growth**: more demand for basic needs, more waste production, and assimilative capacity of nature decreases

Cont...

-- **Disposal areas are getting scarcer every year**.

– **Industrialization**: generation of waste streams with new properties (hazardous)

– **urbanization**

Cont...

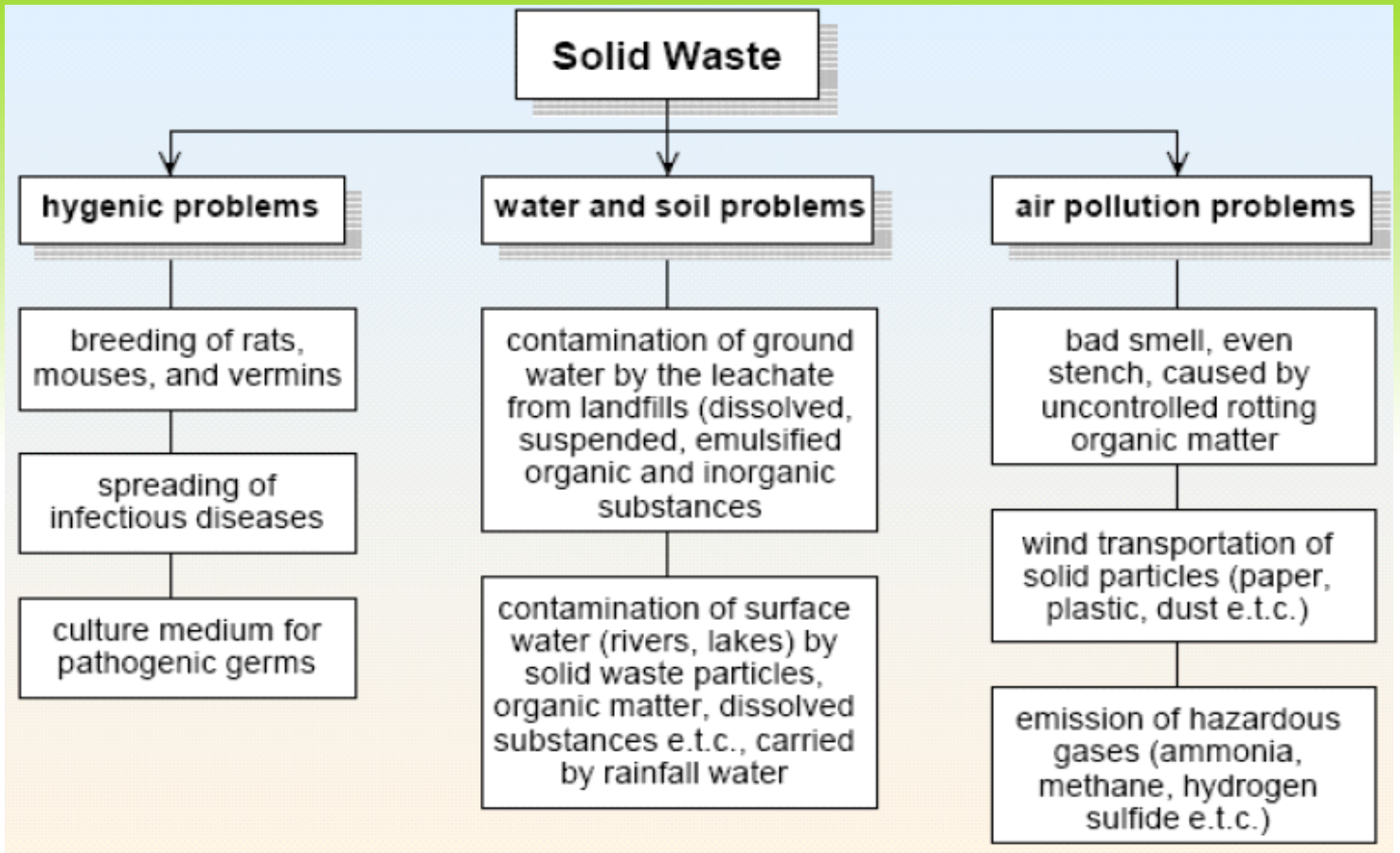


Fig. Problems due to improper SWM

Solid waste Management

Objectives:

- ✓ The objectives of solid waste management is the **proper planning, organizing and implementing of handling, storage, collection, transport, recovery and disposal of waste**;
- ✓ Thus **(SWM**) to minimize and prevent its effect on health, conserve resources and enhance preservation of the environment - land, water and air

Cont...

- ✓ The present concept in SWM is **to dispose off small waste** as possible by means of recovery, recycling and re-use

Type of solid wastes:

The following are some examples of the varieties of solid wastes:

- **Rubbish**: Glass, wood paper process, residues of metal scraps, yard wastes, etc

Cont...

- **Garbage**: Mixed or separate wastes produced during use, preparation, storage, or processing of food such as leftovers, peels etc.
- **Special wastes**: These are wastes that may be hazardous.
  - Includes for example: **chemicals**, petroleum and paint products and residues from pollution control devises etc..

Cont...

- **Junk wastes**: This includes appliances, junks of old cars at backyards, etc.
- **Industrial wastes**: wastes from industries and may include hazardous materials, organic and inorganic residues, wood and paper products, etc.
- **Agricultural wastes**: from agricultural settings such as fertilizer containers, animal manure, crop products, pesticide containers, product residues,etc

Cont...

- **Demolition wastes**: Wastes from construction sites and buildings that are demolished

Management of solid waste:

✓ Management of solid waste may be defined as the process by which workable alternative programs and plans are developed **to solve problems of solid waste**

Cont...

- ✓ In all solid waste management systems the focal points are the six functional elements: Generation –Disposal

1. **Waste generation**: Those activities in which materials are identified as no longer being of value and are either thrown away or gathered together for disposal

Factors that affect waste generation rates.

- ✓The effect of source reduction and recycling activities,
- ✓ **Public attitudes and legislation**,
- ✓geographic and physical factors

2. **On- site handling, Storage, and processing: Those** activities associated with the handling, storage, and processing of solid wastes **at or near the point of generation.**

Cont...

- On-site handling

It is an activity associated with the handling of solid waste until they are placed in the containers used for their storage before collection

- **Importance of on- site handling of solid waste**

- reduce volume of waste generated
- **alter physical form**
- recover usable materials

Cont...

- ✓ On- site handling Methods

- sorting
- grinding
- shredding
- composting

  - ➢ Storage

  It requires facilities for **temporarily storing of refuse** on the premises. Individual house holder or business man has responsibility for onsite storage of solid waste.

Cont...

There are four factors that should be considered: These are

- ✓ **the type of container to be used**
- ✓ **the location where the containers to be kept**
- ✓ **public health**
- ✓ **the collection method and time**

Cont...

- On- site processing

On-site processing is intended to improve disposal options, recover valuable resources, and

prepare materials for recovery as new products or energy.

3. **Collection:** Those activities associated with the gathering of solid wastes and the hauling of wastes after collection to the location where the collection vehicle is emptied.

Residential collection of solid waste:

- ✓ There are different methods of solid waste collection from residential buildings(areas):

1. *curb collection: The* ***home owner*** *is responsible for placing the waste* container **to be emptied** at the kerb (road-side) on collection day and for **returning the empty container.**
2. *Alleys collection: This is arranged between the owner and the* collection crew (optional).

Cont...

3. *Set-out collection: Waste container taken (collected) by crew, and the* **owner is responsible for returning the emptied container**.

4. Set-out set-back: Collection and return of waste container all done by crew.

5. Back yard carry service: Collection crew that go along with the collection vehicle are responsible for bringing out stored solid waste from he back yards of **dwelling units and replacing empty containers in place.**

Cont...

4. **Transfer and transport:** Those activates associated with (1) the transfer of wastes from the **smaller collection vehicle to the larger** transport equipment and (2) the subsequent transport of the wastes, usually **over long distance to the disposal site**.
5. **Processing and recovery:** Those techniques equipment and facilities used both to improve the efficiency of the other functional elements and to recover usable materials from solid wastes.

Cont...

6. **Disposal:** After all efforts are put on making use of solid wastes either by recovery, reuse or recycling something must be done with the solid wastes that are collected and of no further use.

- ✓ There are two alternatives for the disposal of solid wastes:

1. Disposal on or in the earth's surface.

2. Disposal under the sea or ocean.

Cont...

- ✓ The most common method in use today is disposal on land.
- ✓ Methods of disposal on land:

- Open dump
- Controlled tipping
- Sanitary land fill
- Secured land fill
- Composting
- Incineration

Waste Management Hierarchy

- **Prevent** the production of waste, or reduce the amount generated.
- **Reduce** the toxicity or negative impacts of the waste that is generated.
- **Reuse** in their current forms the materials recovered from the waste stream.
- **Recycle**, compost, or recover materials for use as direct or indirect inputs to new products.

Cont...

- **Recover** energy by incineration, anaerobic digestion, or similar processes.
- Reduce the volume of waste prior to disposal.
- Dispose of residual solid waste in an environmentally sound manner, generally in landfills.

✓ Waste management hierarchy are

– Source reduction

Cont...

- Reuse
- Recycle
- Recover
- Treatment
- Secure disposal

• Direct release to the environment (good personal judgment is required)

Health-care Waste Management

What is Health-care waste?

- ✓ Total waste stream from HCW generators (major and scattered sources)
- ✓ 75-90% is general waste (similar to domestic waste)
- ✓ 10-25% in hazardous (infectious, toxic etc.)
  - Diagnosis
  - Treatment

Cont...

- Prevention of diseases
- Alleviation of disablement
- Associated research

➢ **Generators of HCW**

✓ HCW isn’t only produced in hospitals but in a number of other locations:

- **Major sources** are hospitals, clinics, laboratories, blood banks and mortuaries;

Cont…

- **Minor sources** are physician’s office, dental clinics, pharmacies, households, etc.

✓ Apart from producing **different quantities of waste**, these sources also produce **different types of waste**, that require **different kind of treatment and disposal**

Hazard and risk

- ✓ Hazard **is any condition that has a potential to cause injury, illness or loss.**
- ✓ What hazards are there in the health care facilities?
  - Chemical, **physical** and biological

Categories of health-care waste

- ✓**Infectious waste**
- Is suspected to contain pathogens in sufficient concentration or quantity

Cont...

- It cause disease in susceptible hosts.
- This category includes:
  - cultures and stocks of infectious agents from laboratory work;
  - waste from surgery and autopsies on patients with infectious diseases (e.g. tissues, and materials or equipment that have been in contact with blood or other body fluids);

Cont...

- waste from **infected patients in isolation wards**
- waste that has been in contact with infected patients undergoing Heamo-dialysis
- infected animals from laboratories;
- Any other instruments or materials that have been in contact with infected persons or animals.

❖ Note: **Infected sharps are a subcategory of infectious waste**.

Cont...

- Cultures and stocks of highly infectious agents from autopsies,
- animal bodies,

✓ And other waste items that have been inoculated, infected, or in contact with such agents are called **highly infectious waste.**

Cont...

- ✓ ***Pathological waste***
- This category should be considered as a **subcategory of infectious waste**, even though it may also include healthy body parts.
- It consists of **tissues, organs, body parts, human fetuses and animal carcasses, blood, and body fluids.**
- Within this category, recognizable human or animal body parts are also called **anatomical waste**.

.

Cont...

- ✓ **Sharps**
- Sharps are items that could cause cuts or puncture wounds, including:
  - needles,
  - hypodermic needles,
  - scalpel and other blades,
  - knives, infusion sets, saws, broken glass, and nails.

Cont…

- Whether or not they are infected, such items are usually considered as **highly hazardous** HCW

✓ **Pharmaceutical waste**

- It includes **expired, unused, spilt, and contaminated** pharmaceutical products, drugs, vaccines, and sera that are no longer required and need to be disposed of appropriately.

Cont...

- The category also includes discarded items used in the handling of pharmaceuticals, such as:
  - bottles or boxes with residues,
  - gloves,
  - masks,
  - connecting tubing, and drug vials

Cont...

- ✓ **Genotoxic waste**
- It is highly hazardous and may have **mutagenic, teratogenic, or carcinogenic** properties
- It raises serious safety problems, both inside hospitals and after disposal, and should be given special attention
- It may include certain **cytostatic drugs**, vomit, urine, or faeces from patients treated with cytostatic drugs

Cont...

- ✓ **Chemical waste**
- Chemical waste consists of discarded solid, liquid, and gaseous chemicals, for example from:
  - **diagnostic and experimental work**
  - cleaning, housekeeping, and disinfecting procedures.
- Chemical waste from health care may be hazardous or nonhazardous; in the context of protecting health

Cont…

- it is considered **to be hazardous** if it has at least one of the following properties:
  - **toxic**;
  - corrosive (e.g. acids of pH < 2 and bases of pH > 12);
  - **flammable**;
  - reactive (explosive, water-reactive, shock-sensitive);

Cont...

  - Genotoxic (e.g. cytostatic drugs).
- **Nonhazardous chemical waste** consists of chemicals with none of the above properties, such as:
  - sugars,
  - amino acids,
  - certain organic and inorganic salts.

Cont...

- The types of hazardous chemicals used most commonly in:
  - maintenance of health-care centers and hospitals

1. Formaldehyde

- It is a significant source of chemical waste in hospitals

Cont...

- It is used to clean and disinfect equipment (e.g. haemo-dialysis or surgical equipment), to preserve specimens, to disinfect liquid infectious waste, and in pathology, autopsy, dialysis, embalming, and nursing units.

2. Photographic chemicals

- Photographic fixing and developing solutions are used in X-ray departments.

Cont...

- The fixer usually contains 5-10% hydroquinone, 15% potassium hydroxide, and less than 1% silver
- The developer contains approximately 45% glutaraldehyde.
- Acetic acid is used in both stop baths and fixer solutions.

Cont...

3. Solvents

- Wastes containing solvents are generated in various departments of a hospital, including:
  - pathology and histology laboratories
  - engineering departments

4. Organic chemicals

- Waste organic chemicals generated in health-care facilities include:

Cont...

- disinfecting and cleaning solutions such as:
  - phenol-based chemicals used for scrubbing floors,
  - perchlorethylene used in workshops and laundries;
- oils such as vacuum-pump oils, used engine oil from vehicles (particularly if there is a vehicle service station on the hospital premises);

Cont...

- Insecticides, rodenticides.

5. Inorganic chemicals

- Waste inorganic chemicals consist mainly of:
  - acids
  - alkalis (e.g. sulfuric, hydrochloric, nitric, and chromic acids, sodium hydroxide and ammonia solutions).

Risk

- ✓ The **probability** that the hazard of a substance will **cause harm and the severity of that harm**.
- ✓ Who are at risk?
  - Doctors and nurses
  - Patients
  - Hospital support staff
  - Waste collection and disposal staff
  - General public

Cont...

- ✓ Risks associated with poor management of health-care wastes is from
  - Rural health posts,
  - immunization posts,
  - reproductive health posts,
  - mobile and emergency health-care programs,

Cont…

- urban clinics and
- small hospitals

✓ **They are the front line of defense against epidemics** such as:

- AIDS, malaria, and cholera
- a key component of any comprehensive development program

Cont…

- ✓ The medical and health services they provide improve family planning, nurture child and adult health, prevent disease, cure debilitating illnesses, and alleviate the suffering of the dying.
- ✓ The problem is…
  - *Potential health effects because of exposure to infectious & toxic wastes:*
    - AIDS

Cont...

- Hepatitis B and C
  - Studies revealed that:-
    - »33% of HBV direct or indirect
    - »42% of HCV exposure to infectious wastes.

- The “recycling” practices that have been reported, particularly, the reuse of syringes is certainly the most serious problem in a number of countries.

Cont...

- Gastro enteric infections
- Respiratory infections
- Blood stream infections
- Skin infections
- Effects of radioactive substances
- Intoxication

Cont...

- The WHO estimates that over 23 million infections of hepatitis B, C and HIV occur yearly due to unsafe injection practices (reuse of syringes and needles in the absence of sterilization).
  - Re-saleing of needles recovered from the waste
- There is also a public health risk linked to the sale of recovered drugs in the informal sector when the elimination of expired drugs isn’t properly controlled/monitored

Cont…

- In **addition to health risks from direct contact, HCW** can impact human health by:
  - Contaminating water bodies,
  - **Polluting the air**.
    - Open burning

✓ During incineration, if no proper filtering is done, air can also be polluted causing illnesses to the nearby populations.

Cont…

- Emission of toxic gases like:
  - Dioxins dangerous to human health
  - Furans and the environment.

✓ The dumping of HCW in uncontrolled areas can have a direct environmental effect by contaminating soils and underground waters.

Cont...

- ✓ **Fire Hazard**
- ✓ Public nuisance (offensive smells, unsightly debris)

N.B. This has to be taken into consideration when choosing a treatment or a disposal method by carrying out a rapid EIA

- ✓ Proper management of HCW should, therefore, be a critical component of health service activities

Safe management practices

- Waste segregation
- Appropriate packaging of waste
- Waste identification
- Proper storage of waste
- Adequate transportation

Initial handling & storage

✓ Currently little or **no management** is practiced in these heath service giving sectors in **Africa**

Cont…

- ✓ In principle storage…
  - Impermeable, hard standing
  - **Good drainage**
  - Easy to clean surfaces
  - Convenient water supply
  - **Readily accessible to staff**
  - Secure and lockable
  - **Good lighting and ventilation**

Cont…

– Proofed against rodents, insects and birds

Containers, Labeling

- ✓ **Only safety boxes are used in many health care facilities**…
- ✓ the disposal is in open pit, improperly incinerated or disposed of together with general waste

Cont...

- ✓ In principle of containers
  - Date of production
  - **Place of production** (e.g. ward/ establishment*)
  - Waste quantity
  - **Waste category**
  - Waste destination

Cont…

Label… Hazard symbols



 Radioactive waste

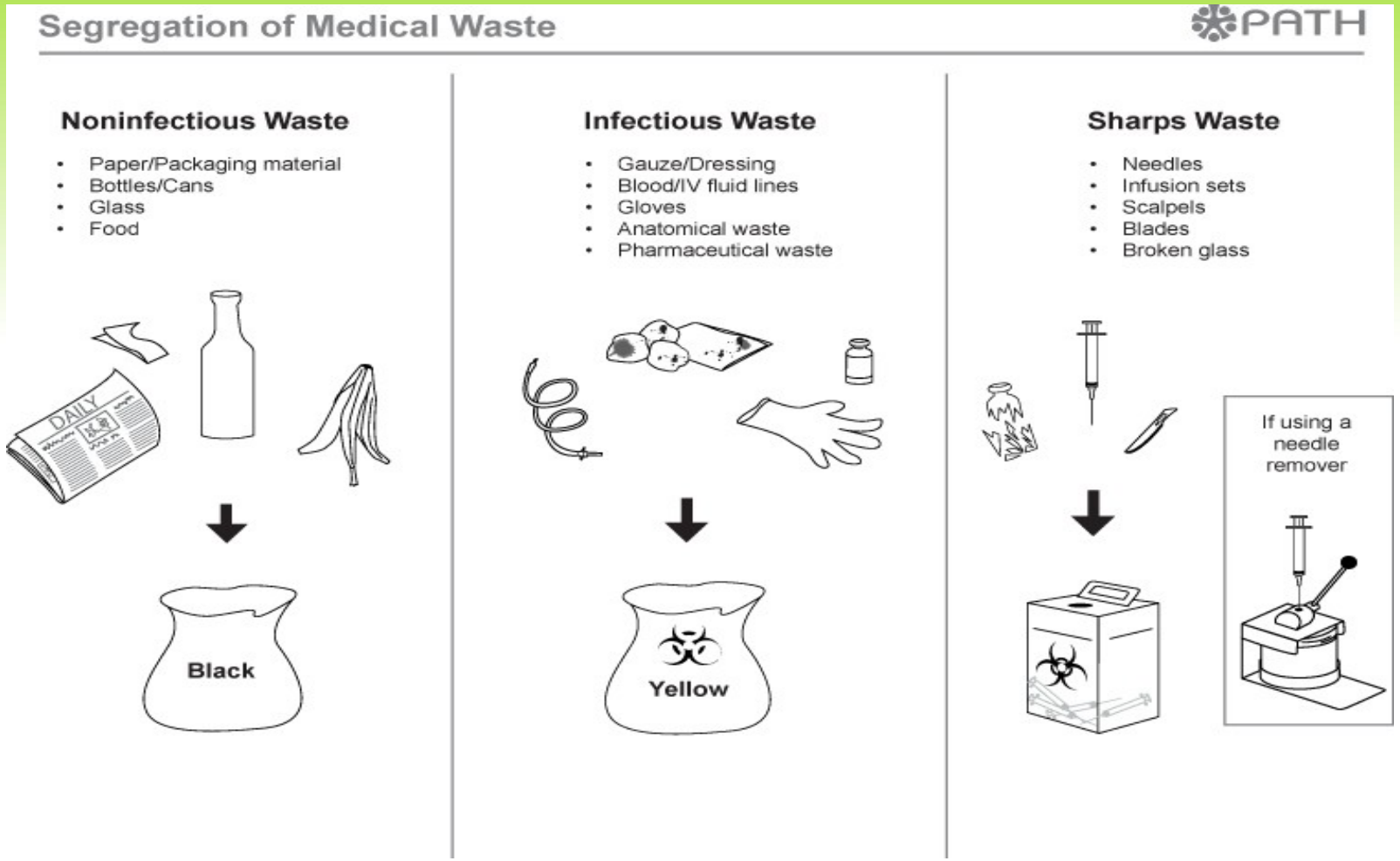
 Health care waste

Fig. Hazard waste symbols

Cont...

- ✓ Recommended color coding of containers
  - **Yellow *for infectious waste***
  - Brown for chemical and pharmaceutical waste
  - **Black *for general waste***
  - Purple for *genotoxic waste*

Segregation Cont…



Workers' health and safety principles

- ✓ **Good occupational health and safety measures** include the following points:
  - Proper training
  - **Personal protective clothing and equipment**
  - Effective occupational health program
  - **Immunization e.g. Hepatitis B vaccine**
  - Post-exposure prophylaxis e.g. **HIV/AIDS**

Cont...

- Medical surveillance
- **Personal Hygiene**

- Convenient washing facilities (with **warm water and soap**) should be available for personnel handling hazardous HCW
- Personnel should be trained on personal hygiene issues that reduce the risk from handling hazardous HCW

Cont...

- **Personal protective equipments**
  - Helmets
  - Respiratory face masks
  - Eye protectors
  - Overalls
  - Industrial aprons
  - Leg protectors
  - Industrial boots

Cont...

- Disposable gloves (medical staff) or
- Heavy duty gloves (waste workers)

Treatment options

✓ Aim of treatment and disposal:

- Limit public health and environment impacts by **transforming the waste into non-hazardous residues by treatment**

Cont...

- Containing the waste/residues to avoid human exposure
- Containing the waste/residues to avoid dispersion into the environment

1. **Incineration**

✓ Reduces organic and combustible waste to inorganic incombustible waste (ashes)

✓ **Reduces significantly waste volume and weight**

Cont...

- ✓ Residues are transferred to final disposal site
- ✓ Treatment efficiency depends on incineration temperature and type of incinerator
- ✓ **Not all wastes can be incinerated**
- ✓ **Investment and operation costs** vary greatly according to type of incinerator
- ✓ Produces combustion gases

Cont...

- Wastes *not to* be incinerated
  - Pressurized gas containers
  - Large amounts of reaction **chemical waste**
  - **Radioactive waste**
  - Silver salts or radiographic waste
  - Halogenated plastics (e.g.. PVC)
  - **Cadmium**
  - Ampoules of heavy metals

Cont...

- ✓ It is considered as an all round treatment option
- ✓ **Mercury containing waste** (e.g. amalgam waste from dentists), as well as the radioactive waste and waste containing significant amounts of heavy metals may not be incinerated

Types of incinerators

- Rotary Kilns: 1200^0 C to 1600^0 C
- Double chamber pyrolitic incinerators: 800^0C-900^0C

Cont...

- Single chamber furnaces with static grate: 300^0C-400^0C
- Simple field incinerators: <300^0C

2. On-site HCW Treatment by hospitals: Autoclaving

✓ Internal treatment is done in small autoclaves and covers only HCW such as:

  - sharps,

Cont...

- culture plates
- small glass tubes with blood samples.

✓ Following autoclaving the waste is without further treatment disposed into the municipal waste containers for disposal at the municipal landfill together with ordinary municipal waste.

Cont...

- ✓ Although the waste has been sterilised via the autoclave treatment the sharps will still be intact and thereby pose a risk for the staff of the municipal waste collection company and scavengers at the landfill.
- ✓ **About 90 % of the yearly amount of infectious waste can be treated in appropriate autoclaves.**

Cont...

- ✓ Chemicals expired or unused pharmaceuticals including cytotoxic waste and mercury containing waste will remain problematic for disposal.
- ✓ Also the pathological waste may not be treated, depending on the selected autoclave type;
- ✓ Setting an autoclave would require less stringent IPPC permit, while monitoring is not as demanding as for incineration, due to lower emissions

Cont…

3. Simple Chemical disinfection

- ✓ Treatment by contact to commonly used products for surface disinfection
- ✓ **Requires shredding of waste**
- ✓ **May introduce strong chemicals into the environment**
- ✓ Efficiency depends on operational conditions
- ✓ **Only the surface is disinfected**

Cont…

- ✓ Human tissue should usually not be disinfected
- ✓ **Special disposal required to avoid pollution of the environment**

Disposal options

1. Safe burial

- ✓ Access to the disposal site should be restricted to authorized personnel only.

Cont...

- ✓ The burial site should be lined with a material of low permeability, such as clay, if available, to prevent pollution of any shallow groundwater that may subsequently reach nearby wells.
- ✓ **Only hazardous health-care waste should be buried.** If general hospital waste were also buried on the premises, available space would be quickly filled up.

Cont...

- ✓ Large quantities (>1kg) of chemical wastes should not be buried at one time. Burying smaller quantities avoids serious problems of environmental pollution.
- ✓ The burial site should be managed as a landfill, with each layer of waste being covered with a layer of earth to prevent odours, as well as to prevent rodents and insects proliferating.

Cont...

2. **Encapsulation**

- ✓ The process uses either **cubic boxes made of high-density polyethylene or metallic drums**,
- ✓ which are three-quarters filled with sharps and chemical or pharmaceutical residues.
- ✓ The containers or boxes are then filled up with a medium such as:
  - plastic foam,

Cont...

- bituminous sand,
- cement mortar, or clay material.

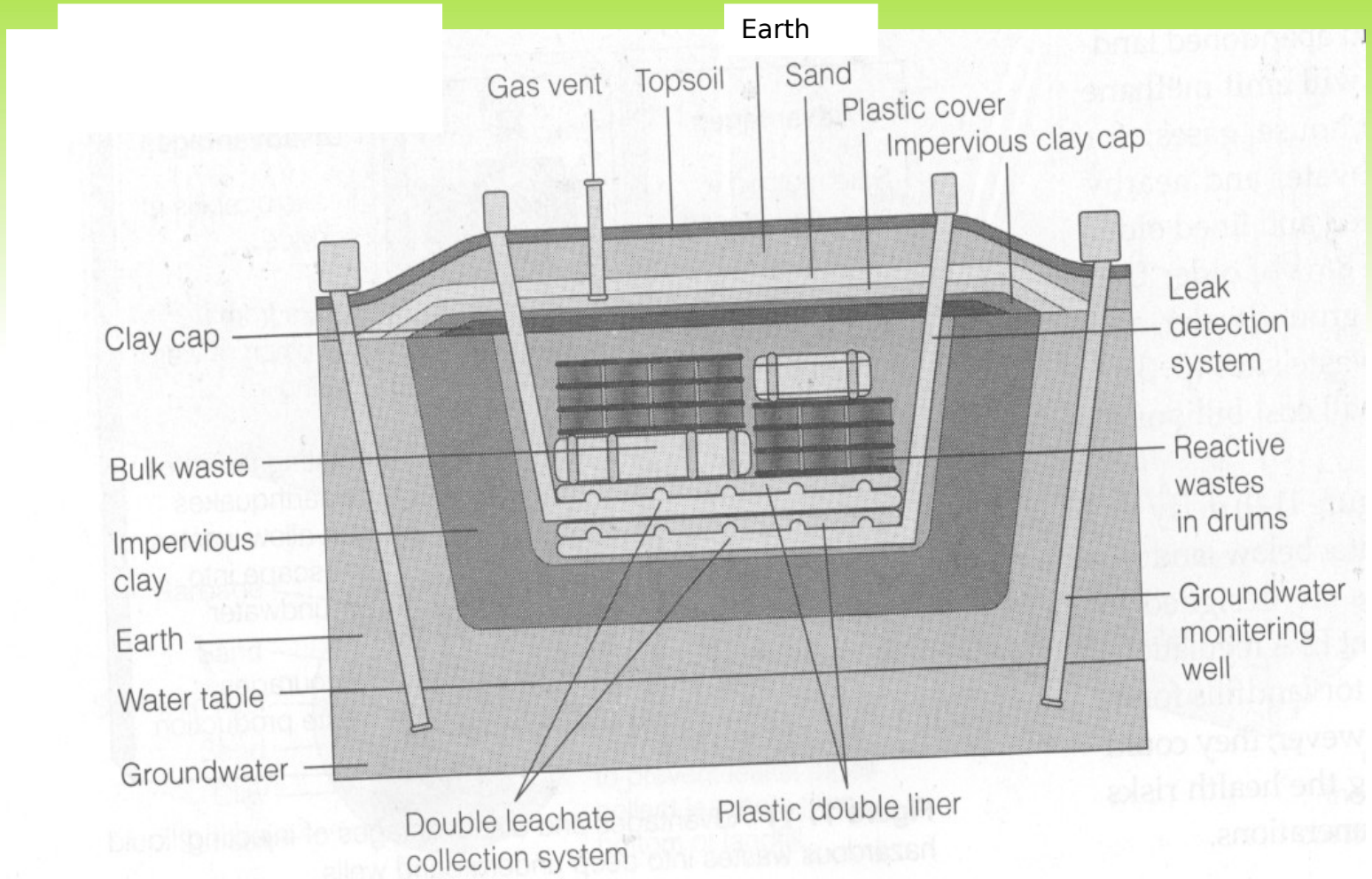
✓ After the medium has dried, the containers are sealed and disposed of in landfill sites.

✓ It is relatively cheap and safe but

✓ Encapsulation alone is not recommended for non-sharp infectious waste

Co nt…

3. Landfills



Options for Specific Types of Waste

- ✓ **Pharmaceutical wastes**
  - Small amounts:
    - **Encapsulate**, disperse in landfill sites, or bury on site
    - **Incinerate**
  - Large amounts
    - **Incinerate** at high temperatures or encapsulate

Cont...

- LANDFILL IS NOT RECOMMENDED

✓ Chemical Waste - Further Recommendations

- Keep different hazardous chemicals separate
- **Do not dispose into the sewers or street**
- **Do not encapsulate large amounts** of disinfectants as they are corrosive and flammable

Cont…

- Do not bury large amounts of chemicals

✓ **Cytotoxic Waste**

- **NEVER LANDFILL or DISPOSE TO SEWER**
- Disposal Options:
  - Return to supplier
  - Incinerate at high temperature
  - Chemical degradation

Cont…

- **Wastes with Heavy Metals**
  - Wastes with mercury, cadmium, lead, arsenic, strychnine, are poisonous (e.g., thermometers, batteries, lead paints, dyes)
  - **Never incinerate or burn**
  - Never dispose of in municipal landfills
  - Best solution: **Avoid purchase** OR

Cont...

- **Recycle** in specialized cottage industry or export to countries with specialized facilities
- **Encapsulation**

✓ **Pressurized Gas Containers**

- NEVER **INCINERATE**
- Return undamaged gas cylinders and cartridges to the manufacturer for reuse

Cont...

- ✓ Damaged containers: empty completely and crush, landfill
- ✓ **Radioactive Waste**
  - Use requires a national strategy including:
  - Appropriate legislation
  - A competent regulatory organization
  - **Trained radiation protection officer to monitor exposures**

Cont...

  - Return to the manufacturer

- Safe handling and disposal of radioactive waste requires a rigorous and relatively complex management scheme

Liquid waste

Introduction

- ✓ It is that **part of a community water supply** after it has been fouled by a variety of uses.
- ✓ The liquid waste may also be fouled by human excreta which is a source of enteric diseases
- ✓ The fouling may include contamination with feces and urine.
- ✓ it is **used water that contains dissolved or suspended matter**

Cont....

Kinds of wastewater

- ✓ Domestic wastewater/sanitary sewage the wastewater produced by humans in their daily lives
  - **Grey water** is the water produced by bathing, cooking, and washing dishes and clothes,
  - … may be high in **detergent pollutants**

Cont...

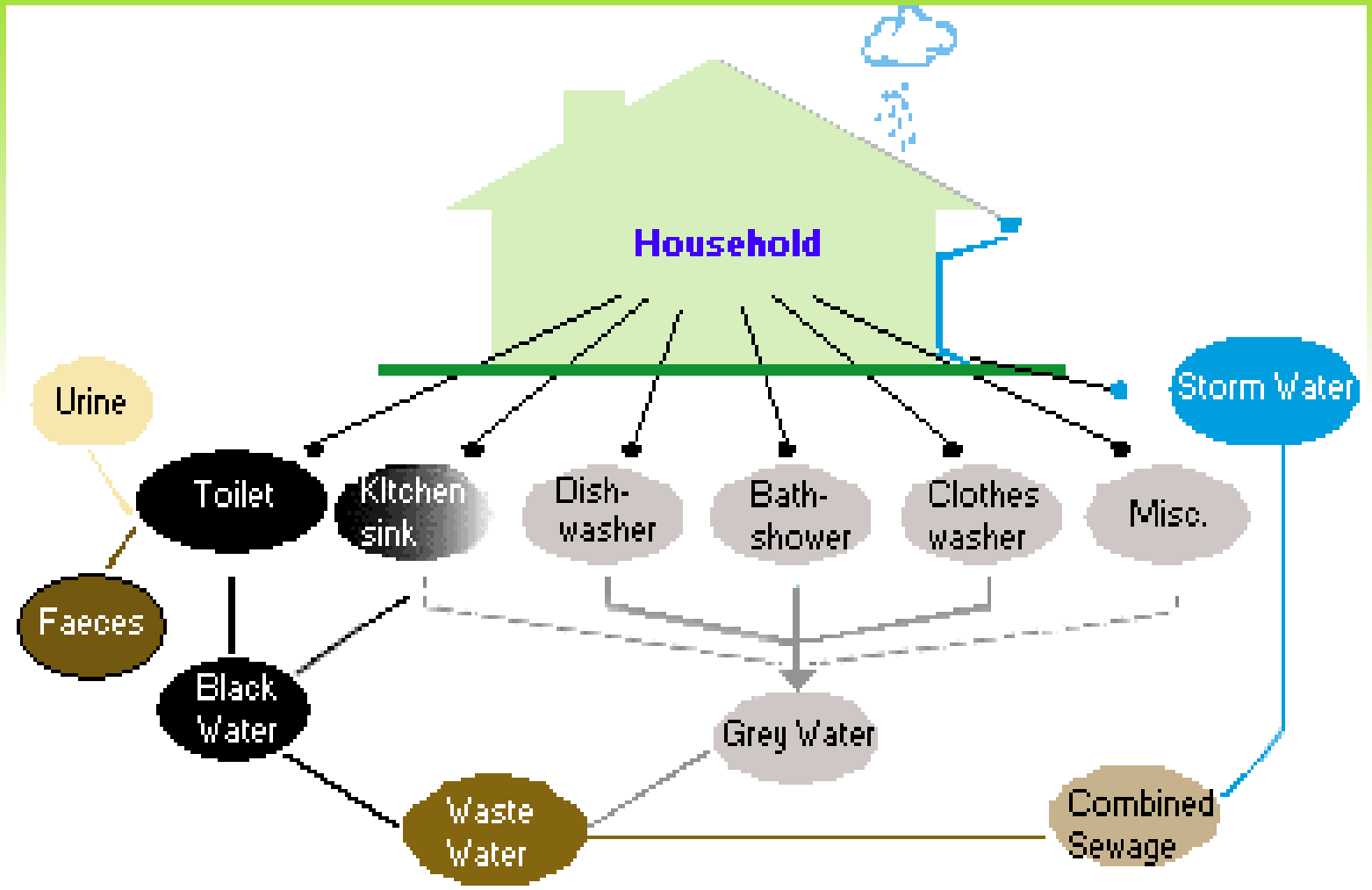
- Generates from a home or community, public buildings or commercial and industrial establishments including:
  - toilet, bath, laundry, lavatory, and kitchen- sink wastes, and surface run off.

✓ **Industrial sewage** is the used water from manufacturing processes

Cont…

- **Storm sewage, or storm water**, is the surface run off caused by rainfall, it carries organics, suspended and dissolved solids, and other substances picked up as it travels over the ground
- **Excreta**: the waste matter mainly faces and urine eliminated from the body

Cont...


Household
Urine
Toilet
Kitchen sink
Dish-washer
Bath-shower
Clothes washer
Misc.
Storm Water
Faeces
Black Water
Grey Water
Waste Water
Combined Sewage

Public health importance of liquid waste including human excreta:

- ✓ Untreated liquid waste including human excreta if accumulated and if not properly disposed of will create the following public health problems:
- **Produces malodorous gases**.
- May serve as a **breeding site** for various insects and rodents.

Cont...

- May contain numerous pathogenic organisms and ova of parasites that dwell in the intestinal tract.
- Contains nutrients which encourage growth of aquatic plants which may lead to **eutrophication** (nutrient rich) of water bodies.
- May carry toxic chemicals that have adverse effects on health, water and soil

Cont...

- May lead to pollution of water bodies devoting them their natural aquatic life due **to lack of dissolved oxygen (DO).**
- Leads to contamination of ground sources of water supplies.
- Create intolerable nuisance.

What are the major sources of wastewater?

- ✓ Home and business
- ✓ Manufacturing wastewater
- ✓ Food plants
- ✓ Paper mills
- ✓ Steel mills
- ✓ Electric power plants
- ✓ Farm wastewater
- ✓ Storm water

Human waste disposal

Objective of human waste disposal system

- **To *isolate totally human excreta* from man's food, water and the immediate environment at large.**

Cont...

What hazards may be in wastewater?

- ✓ Hazardous wastewater is wastewater that is potentially ***dangerous to human health or the environment***
- **Infectious agents**: are any organisms that can cause disease in humans and other living organisms

Cont...

- ✓ The most common infectious agent are:
  - **Bacteria** (fecal coliform bacteria are the bacteria found in the intestines (colon) of mammals)
  - **Viruses** (hepatitis, meningitis, diarrhea, and respiratory disease)

Cont…

- **Protozoa** (amoebic dysentery, diarrhea, and ulcers)
- **Worms** (tapeworm, roundworms, and whipworms)

Human Waste Management

Problems and Need

- ✓ Sanitation is ***safe management of human excreta*** **and other waste product produced by the day to day activities of people**.

Cont.…

- ✓ This definition includes the hardware and software components, as effective interventions need to stimulate both the constructions of sanitary facilities for waste management and their hygienic use.
- ✓ Fecal-oral diseases are among the most obvious endemic diseases throughout the developing countries and more so in Ethiopia

Cont...

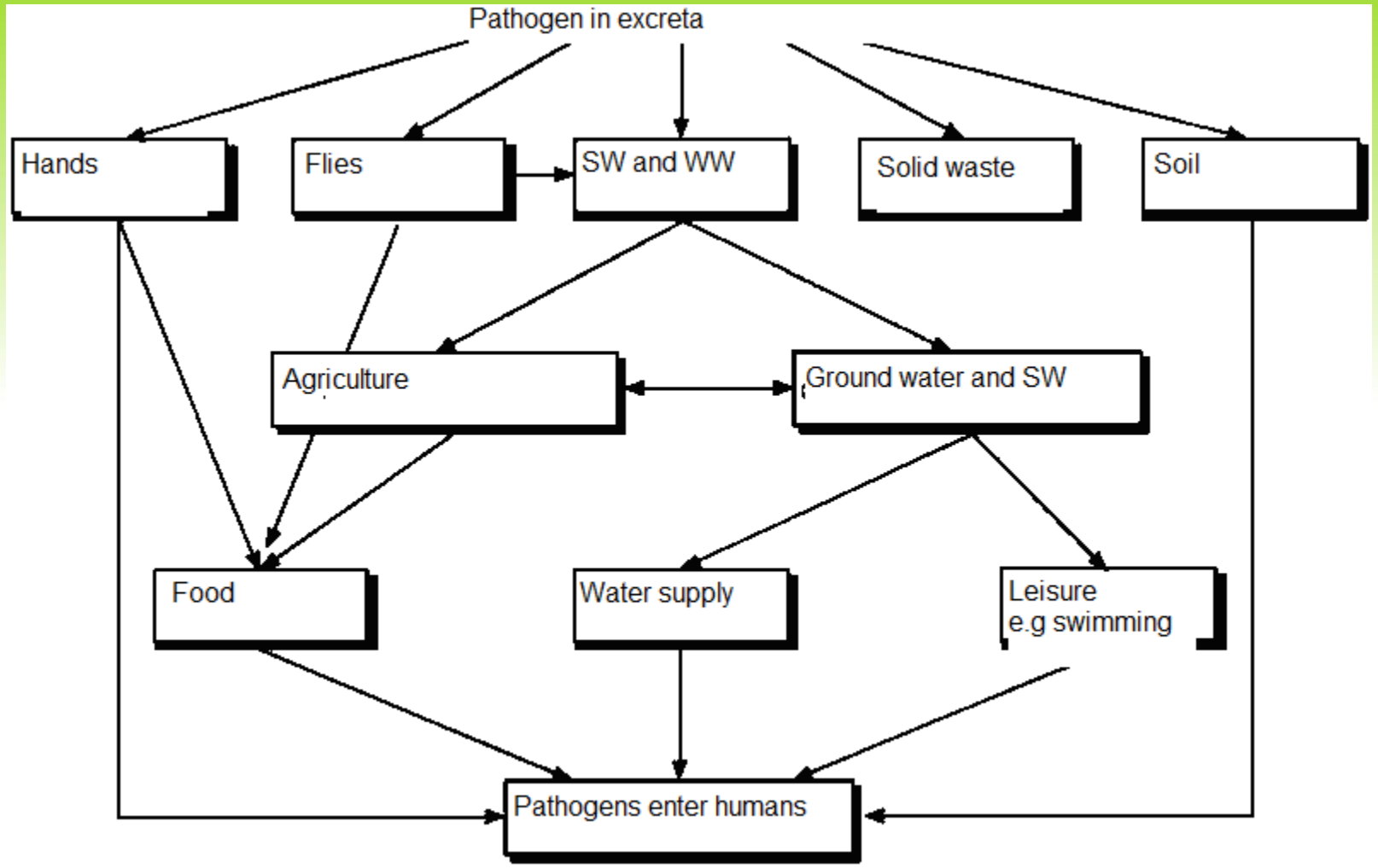
- The **effectiveness of sanitation as an intervention to the fecal-oral diseases varies** because of the following reasons

1. **Bacterial infection** such as cholera involve **large infective doses**, hence they are more susceptible to control through sanitation.

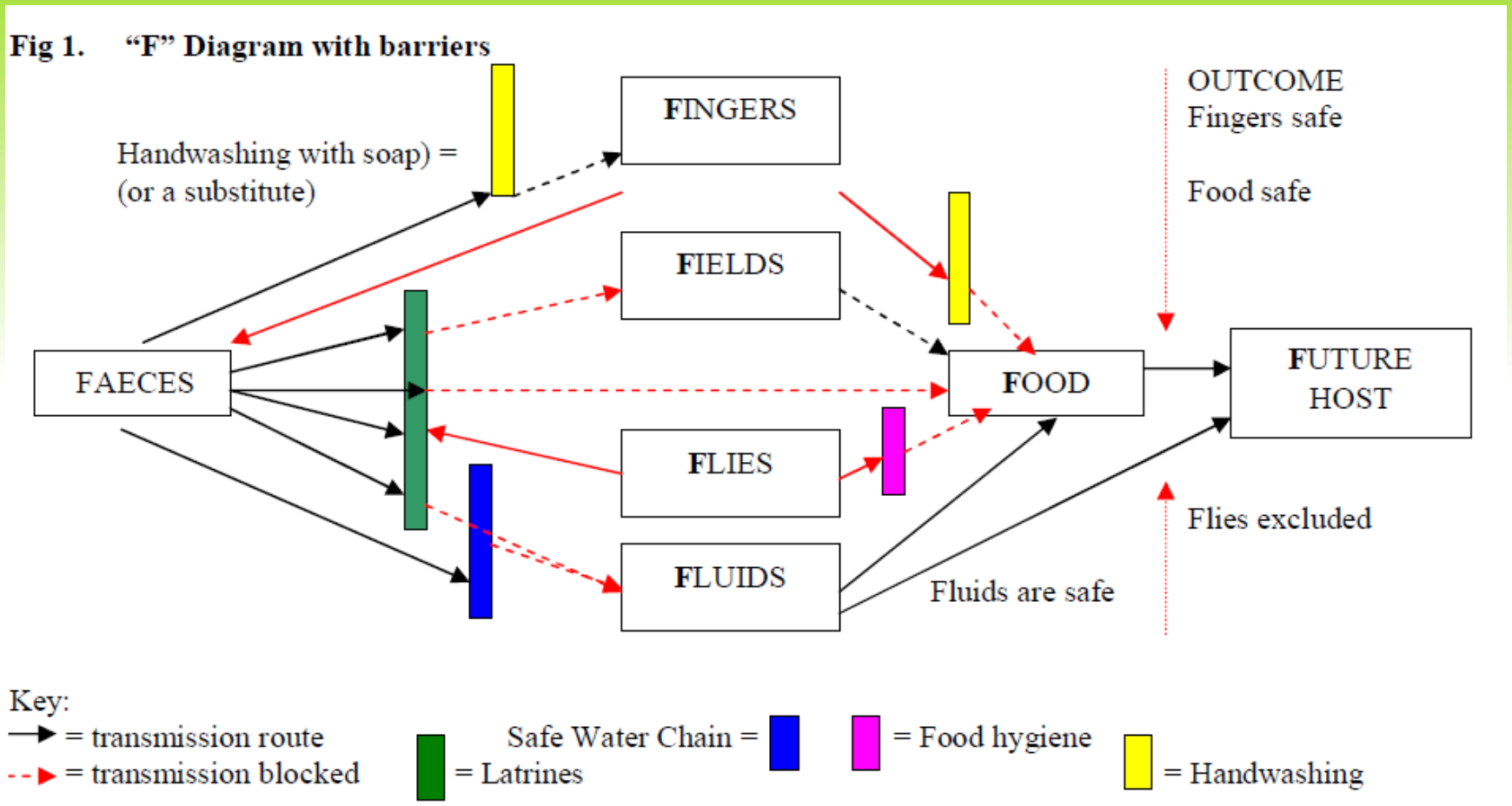
Cont...

2. **Polio or hepatitis require only a small dose to cause the disease**
3. Many diseases such as salomellosis involve transmission cycles that can pass through animal hosts

Transmission routes for pathogens found in excreta



Diseases associated with excreta transmission route and control mechanisms



Excreta borne diseases

- ✓ On the bases of the type and size of their causative agents, excreta born diseases may be classified in to four groups as follows:

1. **Helminthic or metazoan diseases**:

This is further divided in to three major sections

a. ***Round worms*** (nematodes) e.g Ascaris, trichuriasis, hook worm, etc.

Cont...

b. ***Flat worms*** (cestodes) e.g Taneasis-beef, pork, dog, fish tape worm.

c. ***Flukes*** (trematodes) e.g schistosomiasis.

2. **Protozoal diseases:**

a. Amebiasis

b. Giardiasis

3. **Bacterial diseases**:

a. Typhoid and paratyphoid fever (salmonellosis

Cont...

b. Shigelosis

c. Cholera

4. **Viral diseases**:

a. Infectious hepatitis

b. Poliomyelitis

c. Viral diarrhoea

Excreta disposal methods

Excreta disposal methods are mainly two types:

1.Non-water carriage systems: which normally do not use water for caring away (transport) excreta

Cont...

- ✓ are also called **drop and store systems**
- ✓ The following are examples:
- **Pit latrine/pit privy**
- **VIPL**
- Compost latrine
- Aqua privy
- ECOSAN latrine
- Bucket latrine
- Trench latrine

Take three of latrine listed below write their shape and dimension, definition, factors affecting deminsions, advantage and disadvantage.

Cont....

- Overhung latrine
- Borehole latrine

2. Water carriage systems: Excreta is deposited to properly constructed fittings and then **carried away by water through a sewer system** to its final disposal site

✓The water carriage systems again can be grouped into three categories as follows:

Cont...

a. **Drop - flush and discharge systems**

e.g. - pour- flush latrine

- Water carriage system

b. **Individual containment and treatment systems**

e.g. - **Septic tanks**

- Cesspools

- Soak pits

- Seepage pits

Cont...

c. Community treatment systems

e.g - Municipal sewage treatment

Typical examples of excreta disposal systems

1. The pit latrine/pit privy:

- ✓ Common in many parts of the world including rural areas of developed countries.
- ✓ It is a drop-and-store technology.

Cont...

Shape and dimensions:

- Vary from place to place.
- Usually circular or rectangular in shape
- Usually **80-120 c**m diameter or width and depth varying from **2.5 to 5m** depending on the depth of the ground water table.
- Varying in length depending on number of users.

Cont...

Dimension depends on:

- Family size (users)
- Number of holes to have
- Soil formation
- Ground water pollution
- Type of service expected.

Cont...

Advantages of pit latrine:

- Low cost
- Easy to construct
- Uses all types of anal cleansing
- Minimum water requirement

Disadvantages of pit latrine:

- Fly and mosquito nuisance
- Waste can not be recycled
- Smell problem
- Lack of space for relocating new one when full

Cont...

2. The VIPL/ Ventilated Improved Pit Latrine:

- ✓ VIPL is a technical modification of simple pit latrine
- ✓ It is a drop-and-store technology
- ✓ The difference from the traditional pit latrine is that:
  - it is modified to remove odor based on principles of air density and wind movement
  - it is modified to prevent escape of flies that may enter or breed in the pit

Cont...

- ✓ Odor is removed through a vent pipe built on the slab and extended over the roof to about 50cm

Advantages of a VIPL:

- Bad odor is not felt provided the pit floor is kept clean.
- Flies get trapped by the screen on the vent pipe.
- Requires small space for construction.
- **Fulfills the sanitary criteria if properly designed, constructed, used and maintained.**

Cont...

Disadvantages of VIPL:

- Requires vent pipe
- Requires a concrete slab
- **Needs double pit**. Therefore, higher cost than ordinary pit latrine.
- May require lining or construction of a ring to prevent caving in

Cont...

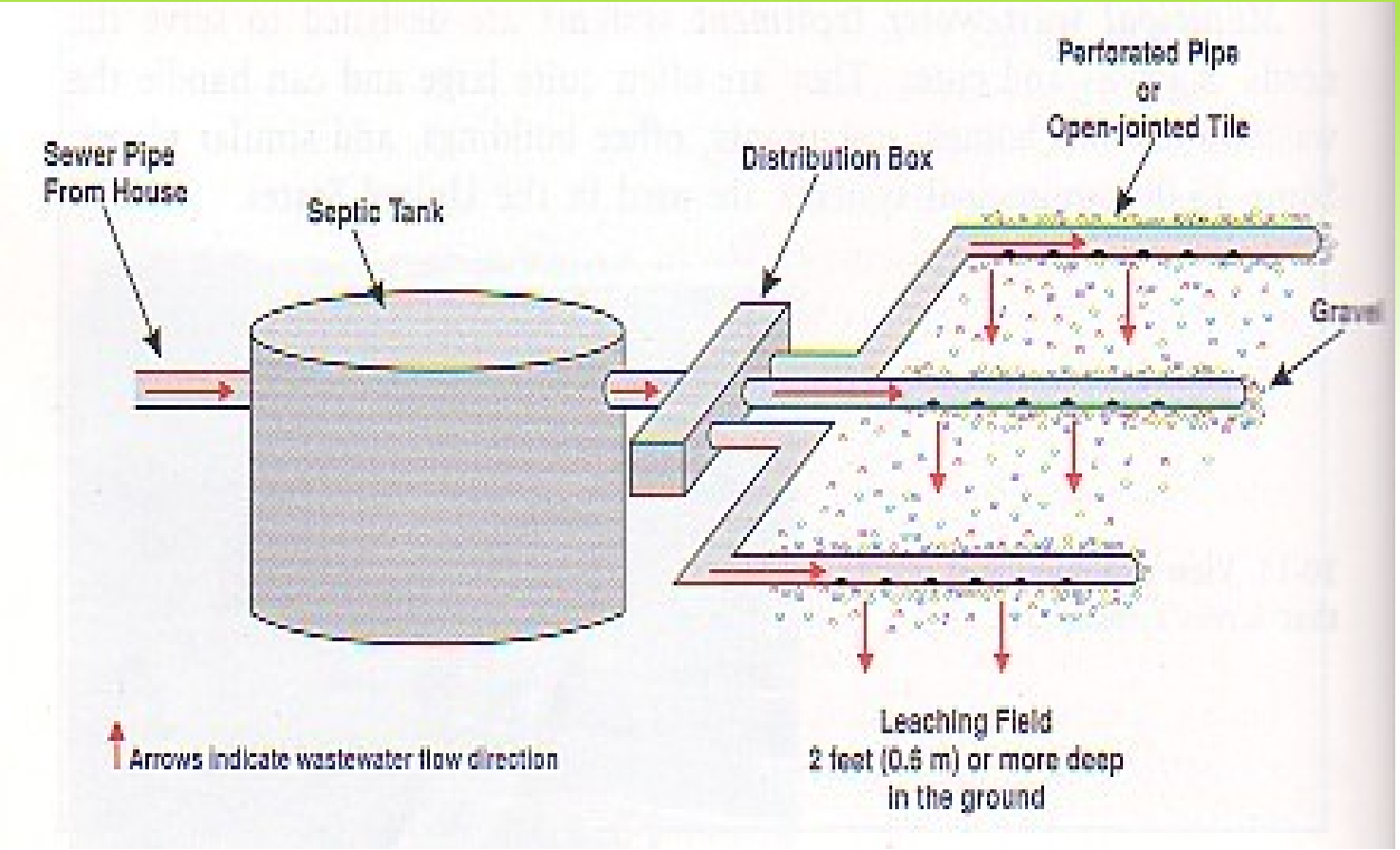
3. Septic tanks is a concrete or steel container buried in the ground

- ✓ The tank serves as a digester where bacteria act on the solid materials
- ✓ The solids settle to the bottom of the tank
- ✓ The liquid passes from the tank into a system of underground pipes that from a leaching field

Cont...

- ✓ The pipes have small holes that allow the liquid to diffuse into the soil
- ✓ Leaching fields should be at least 50 feet from a stream and twice that distance from a water well
- ✓ are cleaned by pumping out the sludge, this is done when the scum and sludge at the bottom of the tank are closer than 30 cm to the top
- ✓ Most tanks need to pumped every 2 or 3 years

Cont...



General layout of a septic tank system

Chapter 4: Food_hygiene_

Learning Objectives

At the end of this chapter, the students are expected to:

- ✓ Define the terms
- ✓ Be aware of health importance of food safety and protection
- ✓ Discuss about food born illness
- ✓ Be aware of classification of food borne diseases
- ✓ Discuss about meat & milk hygiene
- ✓ Know the food preservation methods
- ✓ Describe the categories of food and drink establishments
- ✓ Describe the procedure for sanitary inspection in food and drinking establishments

Introduction

Definition of terms and concepts

Food

- ✓ It is **any solid or liquid**, when eaten and absorbed by the body, it:
  - **produces energy**,
  - promotes the growth and
  - **repair of tissue**;

Cont...

- **promotes resistance** against diseases or maintains and regulates these processes.

Food hygiene: All conditions and measures necessary for ensuring the safety, wholesomeness, and fitness for consumption of food **at all its stages** from its:

  - production, processing, storage, distribution, preservation, and service (WHO/FAO)

Cont…

Food safety **is a scientific discipline describing handling, preparation, and storage of food in ways that prevent food-borne illness**.

- ✓ This includes a number of routines that should be followed to avoid potentially severe health hazards.

Cont…

Objectives of food sanitation

- ✓ The broad objective of food hygiene/sanitation is the **protection of the health of the consumer.**
- ✓ More specifically however, it is designed to:
  - Protect food against infection: to reduce and minimize the opportunity for microorganisms to gain entrance and multiply in food.

Cont...

- **Insure wholesomeness of food**: to assure that the food is:
  - in good condition,
  - prepared and served clean,
  - free from adulteration,
  - free of any substances deleterious to the health of the consumers
- Meet consumer expectations: to prepare and serve food in safe and whole some conditions

Health Importance of food safety and protection

- ***Food-borne illness/poisoning*** is a gastrointestinal disorder that results from eating contaminated food.
  - Infectious organisms — including various bacteria, viruses and parasites — are the most common cause of food poisoning.

Cont...

- Harmful toxins and chemicals (noninfectious agents) also can cause illnesses, but this is less common.
- Every person is at risk of food-borne illness

Causes of food borne illnesses

- ✓ Food-borne illness usually arises from improper handling, preparation, or food storage.
- ✓ Good hygiene practices before, during, and after food preparation can reduce the chances of contracting an illness

Cont...

- ✓ It can also be caused by a **large variety of toxins** that affect the environment, by:
  - chemicals
  - **pesticides or medicines in food**
  - naturally toxic substances like poisonous mushrooms or reef fish.
- ✓ It can be caused by bacteria, parasites, toxins, and viruses

Cont...

- ✓ Bacterial causes are common
- ✓ **Viruses** are likely the most common cause but are seldom investigated and confirmed because of the short duration and self-limited nature of the illness

- **What is Food Borne Illness?**

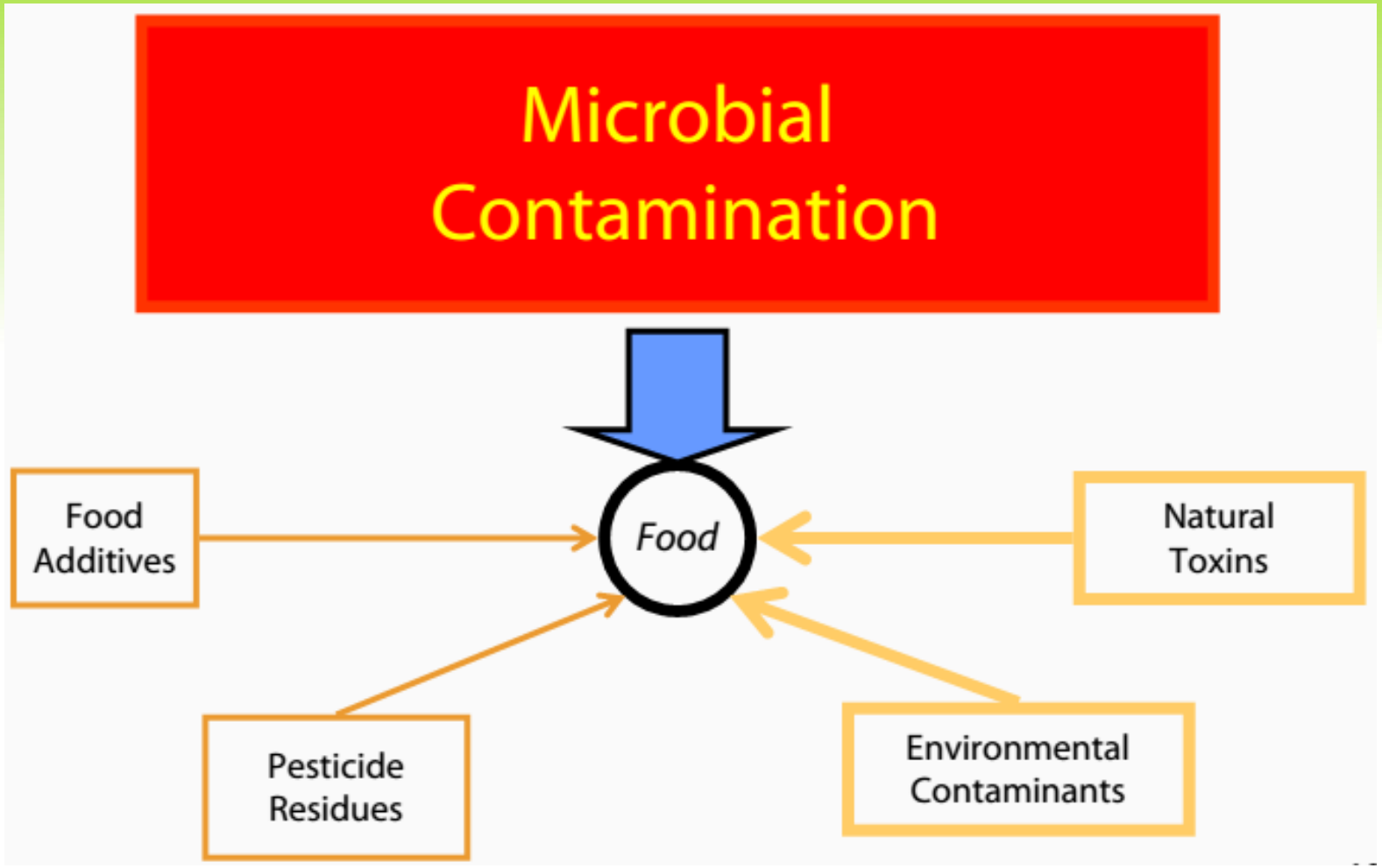
✓ Is a disease which is caused by ingesting of food which is contaminated by:

- Microbial cells

Cont…

- Biological toxins
  - Microbial toxins
  - Poisonous plants
  - Poisonous animals
- Harmful chemicals
  - Intentional
  - Accidental

Causes of Food Contamination



Common symptoms

Stomach Pain Diarrhea
Vomiting
Nausea
Headache



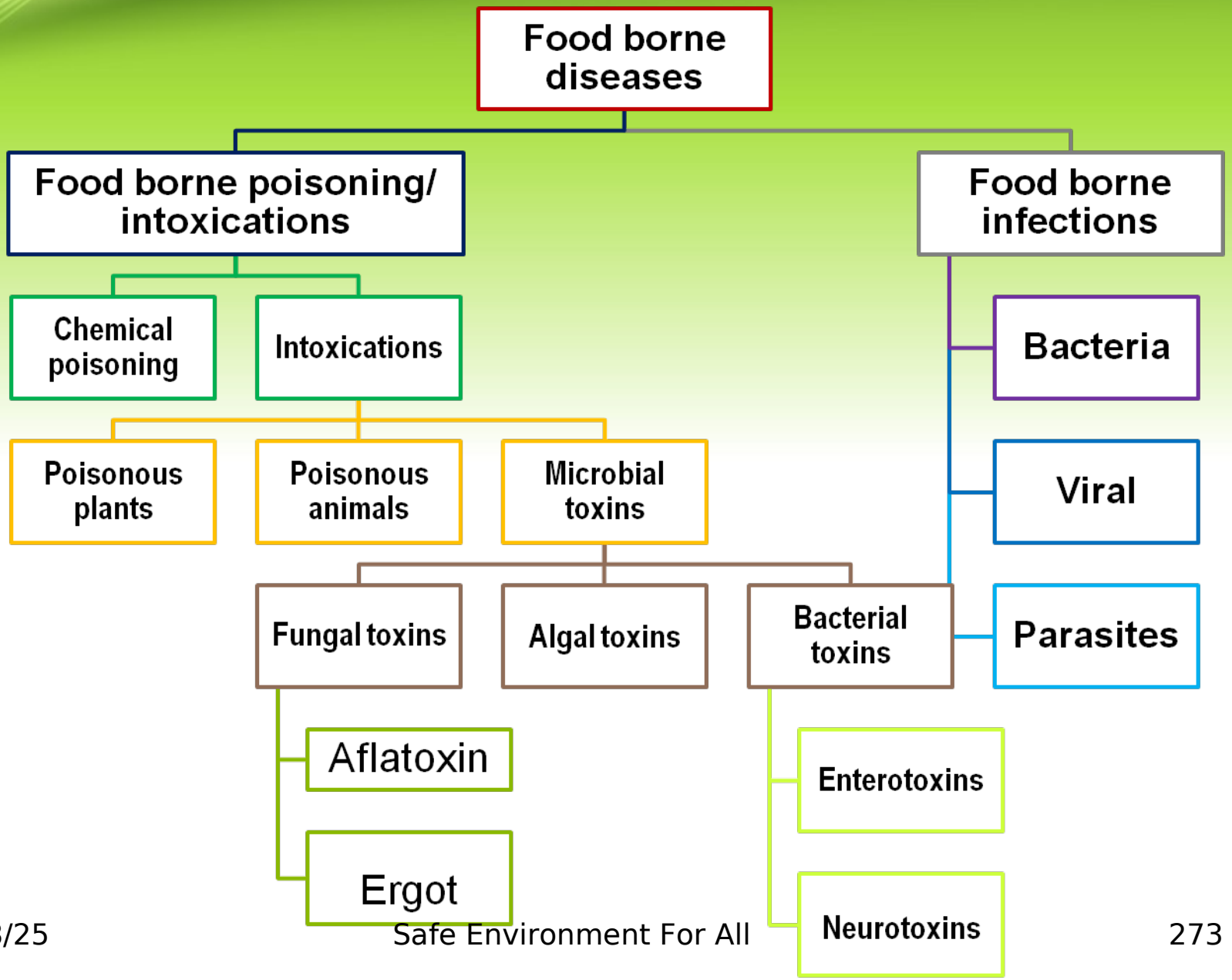
These are symptoms of a FOODBORNE ILLNESS

Microbial food contamination

- The common microbes causing food borne illness are:
  - **Bacteria**
    - ✓Salmonella
    - ✓Campylobacter
    - ✓Bacillus
    - ✓Staphylococcus
    - ✓Clostridium
    - ✓E-coli 0157:H7
  - **Viruses**
    - ✓Hepatitis A
    - ✓Norovirus

Classification of Food Borne Diseases

- Depending on the causative agent they are grouped into two:
  1. Food-borne poisonings/intoxications &
  2. Food-borne infections


Food borne diseases
Food borne poisoning/ intoxications
Food borne infections
Chemical poisoning
Intoxications
Bacteria
Poisonous plants
Poisonous animals
Microbial toxins
Viral
Fungal toxins
Algal toxins
Bacterial toxins
Parasites
Aflatoxin
Enterotoxins
Ergot
Neurotoxins

1. Food Poisoning/Intoxication

- ✓ Caused by ingestion of microbial toxins, swallowing of poisonous plants and animal tissues or due to the consumption of food contaminated by chemical poisonous.
- ✓ The main causes of food poisoning are:
  - Staphylococcal food poisoning
  - E. Coli food poisoning

Cont...

- Gram positive spore forming bacteria
- Poisonous plants
- Poisonous animals
- Harmful Chemicals

✓ **I. Staphylococcal Food Poisoning**

✓ Disease which occurs after eating food which has been contaminated with staphylococcal organisms like:

- S. aureus
- S. epidermides
- S. sapropyticus

Staphylococcus aureus

Toxin	Enterotoxin (heat stable)
IP	1-7 hrs (usually 2-4hrs)
Foods involved	Potato salad, Poultry, Sliced meat, Milk & Milk products
Source	Human & animal origin (human nose & skin/wound)
Contributing factors	Inadequate refrigeration & cooking or heat processing of foods, practicing poor personal hygiene, Keeping food at danger zone
Control measures	Practicing good PH, Exclusion of infected people from food handling, Proper handling of high risk foods, Refrigeration of foods

Haemorrhagic Colitis

Causative agent	Escherichia coli O157:H7 (Shiga toxin)
IP	2- 4 days
Symptoms	Severe abdominal cramps, Bloody diarrhoea, Nausea, Vomiting, Low-grade fever
Foods involved	Ground beef, Unpasteurized apple cider, Unpasteurized milk, Lettuce
Source	Intestinal tracts of infected animals, Fecally contaminated water
Control measures	Thoroughly cook ground beef products, Practicing good personal hygiene, Reheat foods to 165°F for 15 seconds, Refrigerate foods at 41°F or below.

II. Poisoning by Gram positive, Anaerobic Spore forming bacteria

- ✓ Common food borne poisonings caused by gram positive spore forming bacteria:
  1. Botulism – caused by Clostridium botulinum, rod shaped bacteria
  2. Perfringens – Clostridium perfringens rod shaped
  3. Cereus – Bacillus cereus rod shaped bacteria

Botulism

Toxin	Neurotoxin (heat liable)
IP	12- 72 hours (average 1-2 days)
Symptoms	Double vision, Difficulty speaking and swallowing, Difficulty with breathing, Paralysis
Foods involved	Home canned foods, Low acid (alkaline) vegetables, Corn, Peas & other cereals
Source	Soil, Plant crops, Intestine of animals
Control measures	Heating suspected food to boiling temperature for some time, Ensuring lower pH(<4.5), Destruction of spores or inhibiting of their growth, Creating aerobic conditions, Refrigeration of foods to below 5°C, Avoidance of home canned foods

Perfringens Food Poisoning

Toxin	Enterotoxin
IP	8-24 hrs (8-12 hrs)
Symptoms	Abdominal cramps, Watery diarrhoea, Nausea
Foods involved	Meat dishes prepared one day and eaten the next
Source	Soil, Spices, Human & animal intestinal tract, Sewage, Poultry, raw Meats
Control measures	• Proper waste management • Cold storage of foods • Adequate cooking of foods • Good personal hygiene of food handlers

Bacillus Cereus Food Poisoning

Toxin	Enterotoxin
IP	10-16 hours
Symptoms	• Abdominal cramps • Watery diarrhoea • Nausea • Vomiting
Foods involved	Meat pies, Rice, Starchy foods (potato, pasta) Food mixtures (soups, sauces)
Source	Soil, Dust and Water
Control measures	• Thoroughly cook ground meat products. • Cool cooked products to 41°F within 4hrs. • Hold hot foods at or above 140°F.

III. Chemical Food Poisoning

- ✓ Caused by ingesting different chemicals with food
- ✓ It may occur in either of the following ways:

I. Accidental Poisoning

- Carelessly stored chemicals in food premises might be mistaken for food ingredients and could be added to food during preparation

II. Unauthorized additives

- Additives should be added with the right dose with right person





Cont…

III. Residues of chemicals on raw food staffs

- This refers to chemicals which have been applied to control crops, vegetables and fruits during growing, storage or processing and remaining as residues which finally may reach mouth of consumers
- Chemicals applied in food service establishments to control rats, flies, cockroaches and other vermin may contaminate carelessly exposed foods which finally may be ingested with the food





Cont....



IV. Poisons resulting from containers

- ✓ From food utensils & equipment
  - Toxic heavy metals (lead, cadmium, zinc, copper)
- ✓ Contamination from containers that are used to store / hold chemicals

V. Radiation accident food contamination

- ✓ Radionuclide (Radium 226, Iodine 131, Strontium 90, Cesium 137) in the fallout from a nuclear test explosion or a reactor accident can contaminate foods

Cont...

VI. Food sources polluted by toxic/hazardous chemicals such as pollution from industrial effluents

- ✓ In areas where there is extensive industry and mining, fish, vegetables and grains accumulate concentrations of toxic substances such as lead and mercury from industrial wastes/ discharges

IV. Poisonous Animals

1. **Paralytic shellfish poisoning**
   - ✓ By consumption of shellfish (mussels and clams)
   - ✓ Ganyaulax Cantanella (poisonous sea weed)
2. **Fish poisoning**
   - ✓ By eating of tetradon type of fishes





Cont...

IP	5-30 minutes
Symptoms	Trembling lips, Complete loss of power in muscles of extremities and neck, Respiratory paralysis
Control measures	▪ Avoiding eating of shellfish when in doubt and give enough caution for such foods as to where they are harvested and whether the poisonous weed grows in the area. ▪ **Cooking has no effect on poison**

V. Poisonous Plants & Fungus

- ✓ Food poisoning due to the consumption of plants are commonly related to the ingestion of certain toxic fungi.
- ✓ The most common are:
  - Mushroom
  - Water hemlock
  - Grass pea







Mushroom Poisoning

- ✓ Certain species of mushroom, such as:
  - Amanita phalloides &
  - Amanita muscaria
- ✓ These fungi contain certain:
  - Phalloidine & other alkaloids which are poisonous in nature



Amanita phalloides



Amanita muscaria

Cont...

- IP
  - ✓15 minutes to 15 hours
- Symptoms-
  - ✓Salivation
  - ✓ abdominal pain
  - ✓ intense thirst
  - ✓ nausea
  - ✓Vomiting
  - ✓Watery stools
  - ✓Excessive perspiration
  - ✓Flow of tears &
  - ✓Death in many instances
- **Cooking has no effect on the poison**

Fungal poisoning

- **Ergot**

- ✓ Ergot is produced by a group of parasitic fungus called **Claviseps purpurea**
- ✓ These fungi produce the ergot poison in certain cereal crops such as wheat, barely
- ✓ Ergotism is a crippling disease which affects different areas of the body such as the extremities, legs, arms, breasts

Cont…

- IP
  - ✓ Is very long as it is dependent on the consumption of several meals containing the toxin
- Symptoms
  - ✓ Gangrenous involvement of the limbs specially the fingers, toes, occasionally ears and nose
  - ✓ Weakness
  - ✓ Headaches
  - ✓ Painful cramps in limbs
  - ✓ Itching of the skin

Cont…

- Control measures
  - ✓ Protecting the cereal grains from contamination by ergot producing fungus during growing, storage and processing of the cereals by application of fungicides
  - ✓ If possible, avoiding consumption of single cereal grains such as barley & wheat for long period of time
  - ✓ **Cooking or baking has no effect on the poison**

Other fungal toxins

- Aflatoxins
  - ✓ Carcinogens produced in fungus-infected grains and nut products
- Fumonisins
  - ✓ Carcinogens produced in fungus-infected corn

Food borne Infections

- ✓ Caused by consuming foods or liquids contaminated with:
  - Bacteria
  - Viruses
  - Parasites
- ✓ These pathogens cause infection by:
  - **Invading and multiplying** in the lining of the intestines and/or other tissues.
- ✓ Mode of transmission – indirect

Bacterial food borne infections

- The main causative agents of bacterial food borne infections are:
  - Salmonella
  - Vibrio
  - Shigella
  - Camphylocter
  - Listeria

Salmonellosis

Causative agent	Salmonella sps.
IP	6-72 hrs (12- 36 hrs)
Symptoms	Diarrhea, stomach cramps, fever, loss of appetite, headache, nausea & vomiting
Foods involved	Milk, Egg, Poultry
Source	Infected human & animal intestine
Control measures	Hand washing, Thoroughly cooking of all foods, Avoiding recontamination of cooked foods, Do not use raw/cracked eggs Use only pasteurized milk and milk products Keep cold food below 5°C and hot food above 60°C. Educating FH on how to

Typhoid Fever

Causative agent	Salmonella typhi
IP	1-3 weeks
Symptoms	Fever, headache, weakness, loss of appetite, cough & rash, constipation (in adults)
Foods involved	
Source	Intestine of infected human, Water, Soil
Control measures	• Practice good personal hygiene, Practice basic food safety precautions, Avoid water that might be contaminated, Do not drink untreated surface water • A vaccine for typhoid fever is available.

Shigellosis (Bacillary dysentery)

Causative agent	Shigella spp.
IP	1-7 days (1-3 days)
Symptoms	mild to severe diarrhea, fever, nausea, vomiting & cramps, Stools may contain blood, mucus and pus
Foods involved	
Source	Intestines of infected persons, soil, food, water
Control measures	Practice good personal hygiene, Practice basic food safety precautions, Avoid water that might be contaminated

Cholera

Causative agent	Vibrio cholerae
IP	Few hrs to 5 days (2- 3 days)
Symptoms	severe diarrhoea, vomiting, dehydration & shock, death (if untreated)
Foods involved	Seafood (fish, crab, shrimp, oysters), raw or undercooked
Source	Water, intestine of infected humans
Control measures	• Thoroughly cook seafood • Practice good personal hygiene • Proper sanitation of food contact surfaces and utensils • Use a safe water supply

Listeriosis

Cause	Listeria sps. (Listeria monocytogenes)
IP	2-21 days
Symptoms	Meningitis, Spontaneous abortions, Stillbirths, Nausea, Fever, Diarrhoea, Encephalitis, Vomiting
Foods involved	Unpasteurized milk, Soft cheeses made from unpasteurized milk, Raw fruits and vegetables Ready to eat deli meats & salads, Hot dogs
Source	Intestinal tracts of animals & humans, Soil, Contaminated water, Manure
Control measures	Thoroughly cook foods, Use pasteurized milk, Proper sanitation of food contact surfaces and utensils, Thoroughly wash fresh fruits and vegetables, Prevent cross contamination.

Campylobacterosis

Causative agent	Campylobacter jejuni
IP	2-3 days
Symptoms	Abdominal cramps, Headache, Diarrhoea, Fever, Watery and occasionally bloody stools
Foods involved	Poultry, Unpasteurized milk, Raw meat (beef, pork, mutton), Shellfish
Habitat	Normal microflora of most animals & poultry, Contaminated water, Infected pets
Control measures	Thoroughly cook meat, poultry and fish, Proper hand washing after handling raw meat, poultry and seafood, Use pasteurized milk, Use a safe water supply

Viral Food borne infections

- ✓ The main are:
  - Norovirus
  - Hepatitis A
  - Rota virus

Rotavirus gastroenteritis

Cause	Rotavirus
IP	1–3 days
Symptoms	Vomiting, watery diarrhoea, abdominal pains and mild fever
Foods involved	Ready-to-eat foods such as salads, sandwiches, baked products, contaminated water
Habitat	Human faeces, faecal contaminated waters, faecal contaminated food
Control measures	Prevent ill food workers from working until fully Recovered, Ensure that food workers practice good personal hygiene, Avoid cross contamination, Clean and sanitize food contact surfaces, Use potable water

Hepatitis A

Causative agent	Hepatitis A virus
IP	10-50 days
Symptoms	Loss of appetite, Nausea, Vomiting, Fever, Jaundice
Foods involved	Seafood, Any food handled by an infected food handler
Habitat	Intestinal tracts of infected humans, Contaminated water
Control measures	Thoroughly cook seafood including oysters, Practice good personal hygiene

Parasitic food borne infections

- ✓ The main causative agents which lead to parasitic food borne infections include:
  - Giardia
  - Amoeba
  - Tania
  - Trichinella

Giardiasis

Causative agent	Giardia lamblia
IP	1-4 weeks
Symptoms	Diarrhoea, Bloating
Foods involved	Water, Any food handled by an infected food handler
Habitat	Intestinal tracts of infected animals & humans, Water
Control measures	Proper disposal waste, drinking of chlorinated water, Cooking contaminated foods, Boiling suspect water, practice good personal hygiene

Trichinosis

Causative agent	Trichinella spiralis
IP	1 day – 8 weeks
Symptoms	Diarrhoea, Fever, Profuse sweating, Weakness, Muscular pain, Swelling around eyes
Foods involved	Pork, Wild game (bear)
Habitat	Muscle tissue of infected animals
Control measures	• Thoroughly cook pork and wild game • Storing infected meat in a freezer with a temperature no higher than -13^{0}F for 10 days will also destroy the parasite

Meat hygiene

- ✓ Is the *creation of conditions and implementation of measures necessary to ensure the safety and suitability of meat at all stages* of the meat production chain.
- ✓ Effective hygiene control is vital to avoid the adverse human health and economic consequences of unsuitable meat and meat related illnesses.

Importance of meat hygiene

1. **Prevention of food borne disease outbreaks**. Food borne diseases leads to consumer suffering and loss of life.

Cont...

2. **Prevents meat deterioration that may lead to unnecessary losses**
3. Enhances local and international trade in meat due to enhanced consumer confidence
4. Creates employment as more income is realized from sale of meat.

- To ensure a safe meat supply , the following must be practiced:

Cont...

- ✓ **Care** should be given to the animals during transport and at collection centers
- ✓ **Ante mortem examination** should be conducted to ensure the elimination of unfit animals
- ✓ **Postmortem examination** should be carried out to separate the diseased or unfit parts of meat
- ✓ **Separation of unfit materials** from edible products should be in a hygienic manner

Slaughter houses

- ✓ Is an **establishment engaged in killing of animals for human consumption**.
- ✓ It **varies in size** from the backyard of a local butcher to the great meat processing plants.
- ✓ In most countries it is **privately owned**.
- ✓ But most of the peoples in **our country slaughter** food animals in **open fields**

Cont….

- **Problems of open field slaughtering**
  - ✓ **Immediate inspection** of meat by meat inspectors is **impossible**
  - ✓ It is the usual practice that **all the people** who attend the animal slaughter **will share and eat raw meat**
  - ✓ Any remaining blood due to incomplete slaughtering may spoil the meat
  - ✓ **Hygienic** handling of meat is **less** and quality may be affected

Cont...

- ✓ The **quality of** hides and **skins** may be **affected**
- ✓ It may create an unsanitary environment that cause the breeding of flies , smell and nuisance

Meat borne diseases

✓ Three groups of meat borne diseases

1. Viral

- Foot & mouse disease
- Render pest
- Bovine viral diarrhea

Cont...

2. **Bacterial**
   - Tuberculosis
   - Brucellosis
   - Anthrax

3. **Parasitic**
   - Taniasis
   - Trichinosis

Milk hygiene

- ✓ It is a study of all the methods **necessary to ensure the production, handling, and final delivery to the consumer of clean, wholesome and unadulterated milk or milk products.**
  - Purpose of milk hygiene
    - ✓ **Provision of safe and wholesome milk** and its products for the consumers.

Cont…

- To **prevent contamination of milk** proper practices should be followed from production to consumption.

Sources of contamination

1. **Contamination from human discharge and wastes**
   - Construction of a proper waste disposal system
   - Practices of good personal hygiene
   - Segregation of animals from human habitation

Cont...

2. **Contamination from air borne dust & droplets**
   - ✓ Proper construction of the milking area
   - ✓ Sneezing or coughing away from milking containers during milking
3. **Contamination from animal bodies, hides, udder and teats**
   - ✓ Clipping, brushing, cleansing and sanitizing before milking

Cont...

4. **Milk containers** (milking utensils & dirty water)
   - ✓Proper washing and storing of milking containers
   - ✓Using proper and easily cleanable utensils

5. **Milk handlers and milkers**
   - ✓Keeping the milker’s level of personal hygiene high
   - ✓Washing of hands with detergents before milking
   - ✓The milker should always wear clean garments while milking

Cont…

6. **Diseased cows**
   - ✓Detecting and isolating affected animals
   - ✓Veterinary inspection and supervision of animals
   - ✓Treatment and vaccination of animals.

Milk-borne diseases

✓Milk is an excellent food for man but **it is an ideal medium for the growth of micro-organisms.**

Cont…

- From the time milk leaves the udder of the animal, unless adequate safeguards are maintained, it may receive bacteria and other micro-organisms from the surrounding.

▪ Diseases resulting from infected carriers

- Typhoid & paratyphoid fever
- Tuberculosis (human)
- Diphtheria
- Scarlet fever

▪ Diseases transmitted from infected cows

- Tuberculosis (bovine)
- Undulant fever (Brucellosis)
- Anthrax
- Q-fever
- Mastitis (bovine)

Adulteration and Misbranding

Adulteration

- ✓ The **addition of adulterants** is called *adulteration.*
- ✓ Food that **intentionally and illegally** contains any substance other than its genuine component
- ✓ Adulterants are chemical substances which should not be contained within other substances (e.g. food, beverages, fuels or pesticides) for legal or other reasons.

Cont…

- ✓ Adulterants may **be intentionally** added to substances to **reduce manufacturing costs**, or for some deceptive or malicious purpose.
- ✓ Adulterants may also be **accidentally or unknowingly** introduced into substances. E.g.
  - Water added to milk;
  - **smashed banana added to butter**;

Cont…

- maize oil added to pea nut oil;
- **melted sugar to honey**;
- **unauthorized color additives to ‘Tej’**

Misbranding/Mislabeling

✓ To brand or label misleading or fraudulent **information about the content on food inside a container**

Control of food spoilage

Food spoilage *m*eans the **original nutritional value, texture, flavor** of the food are:

- damaged,
- **the food become harmful to people** and
- **unsuitable to eat**.

✓ It makes the food unsuitable, unhealthy, and undesirable for eating.

Cont...

- ✓ It is of **more aesthetical** than disease causing (contaminated food).
- ✓ It is the reciprocal of ‘fresh food’.



The picture of spoiled food

Causes of the spoilage of food

A. Microbial spoilage:

There are three types of **microorganisms** that cause food spoilage -- **yeasts, moulds and bacteria**

B. Autolysis

✓**Enzymes:** are proteins found in all plants and animals.

- If uncooked foods are not used while fresh, enzymes cause undesirable changes in color, texture and flavor.
- are destroyed easily by heat processing.

Cont...

- ✓ Oxidation by air: Atmospheric oxygen can react with some food components which may cause rancidity or color changes.

C. Other factors

- ✓ **Infestations** (invasions) by insects and rodents, which account for huge losses in food stocks.
- **Low temperature injury** - the internal structures of the food are damaged by very low temperature.

Food and microorganisms

Basic Growth requirement of micro-organisms

- ✓ Since our foods are of plant and animal origin, it is worthwhile to consider those characteristics of plants and animals tissues that affect the growth of mo.
- ✓ The plants and animals that serve as food source have all evolved mechanisms of defense against the invention and proliferation of mo, and some of these remain in effect in fresh foods.

Cont…

Intrinsic parameters

- ✓ The parameters of plant and animal tissues that are an **inherent part of the tissues** are referred to as intrinsic parameters.
- ✓ These parameters are

1. **pH**: potential hydrogen

- ✓ Represents the concentration of hydrogen ion and it is used to measure the degree of acidity and alkalinity.

Cont...

- ✓ Most microorganisms grow best at a pH values around 7.0 (6.6-7.5)
- ✓ Most bacteria prefer slightly alkaline (7.2 - 7.6)
- ✓ Most pathogenic micro-organisms have an optimum PH requirement (ranging 6-8)
- ✓ It is a common observation that **fruits** generally undergo **molds and yeast spoilage**, and

Cont...

- ✓ this is due to the capacity of these organisms to grow at a PH values <3.5, which is considerably below the minima for most food spoilage and all food poisoning bacteria.

2. **Moisture content**

- ✓ One of the oldest methods of preserving foods is drying or desiccation, and precisely how this method comes to be used is not known.

Cont...

- ✓ The preservation of foods by drying is a direct consequence of removal or binding of moisture, without which microorganisms do not grow.

3. **Nutrient content**

- ✓ In order to grow and function normally, the mo of importance in foods require the following:

A. Water requirement

- Makes up 80% of bacterial cell

Cont...

- Essentially for bacteria water acts as a solvent to bring essential nutrients to the cell and metabolic waste products are removed from the cell.

B. Source of energy

- As a source of energy, food-born mo may utilize **sugar**, **alcohol**, and **amino acids**.
- Some few mo are able to utilize complex carbohydrates such as starches and cellulose as source of energy by first degrading these compounds to simple sugars.

Cont...

- Fats are used also by microorganisms as source of energy, but these compounds are attacked by a relatively small number of microbes in foods.

C. Source of nitrogen

- The **primary nitrogen sources utilized by Hetrotrophs** (MOs which Obtain their food decomposing complex organic material into simpler) are amino acids.

Cont...

D. Vitamins and related growth factors

- Mo may require **B vitamins in low quantities**, and almost all natural foods tend to have an abundant quantity for those organisms that are unable to synthesize their essential requirements.

E. Minerals

- Antimicrobial constituents

Cont...

- The stability of some foods against attack by mo is due to the presence of certain naturally occurring substances that have been shown to have antimicrobial activities.
- Example Lacterin & Anti-coliforms in the first draw of milk, Lysozome in egg white, some spices are known to contain essential oils that possess antimicrobial activity.

Cont...

F. **Biological Structures**

- The natural covering of some foods provides excellent protection against the entry and subsequent damage by spoilage organisms.
- Examples, the testa of seeds, the external covers of fruits/vegetables, the shell of nuts, the hide of animals, and the shells of eggs

Cont...

G. **Oxygen requirement**

- Some microorganisms need oxygen for growth and multiplication while others do not.
- Based on the oxygen requirement micro organisms are divided in to:
- Aerobes
  - **Obligate aerobes**- are aerobes which can **never survive in the absence of oxygen**

Cont...

- Facultative aerobes - Basically aerobes but can survive both at the presence and absence of O_2

- Anaerobes
  - **Obligate anaerobes**: are anaerobes which can **never survive in the presence of oxygen**

Cont...

- Facultative anaerobes - Basically anaerobes but can survive both at the presence and absence of O_2

Extrinsic parameters are those properties of the storage environment that affect both the foods and their microorganisms

1. **Temperature of storage**

✓ Microorganisms grow over a very wide range of temperatures.

Cont...

- ✓ Therefore, it would be well to consider at this point the temperature growth ranges for organisms of importance in foods as an aid in selecting the proper temperature for the storage of different types of foods.
  - Potentially hazardous food: below 45 ^{o}F (7.5 ^{o}C) or above 140 ^{o}F (60 ^{o}C)
  - Frozen food: below 0 ^{o}F (-17.8 ^{o}C) i.e. frozen food storage

Cont...

- Cold or chill food storage at 34-45 ^{o}F (1.1-7.5 ^{o}C) Slow bacterial growth
- Normal room T^{o} at 70-100 ^{o}F (21.1-37.8 ^{o}C) Rapid bacterial growth
- Food cooked to 165 ^{o}F (73.9^{o}C) most bacteria are killed

✓ The lower temperature for micro-organisms to grow is (-34°C) and the highest is (120°C).

Cont...

- It is customary to place microorganisms into three groups based on this temperature requirement for growth.
  - **Psychrophilic** (cold temperature liking bacteria)
  - **Mesophilic** (middle temperature liking bacteria)
  - **Thermophilic** (Heat liking bacteria)

Cont…

2. **Relative humidity of the environment** is a term used to describe the amount of water vapor that exists in a gaseous mixture of air and water.

- ✓ In other words it is the Moisture in the atmosphere.
- ✓ Foods that undergo surface spoilage from:
  - molds,
  - yeasts, and

Cont...

- certain bacteria should be stored under conditions of low relative humidity which helps to reduce the growth of mo and thereby the acceptability of food.

✓ Presence and concentration of gases in the environment

✓ Carbon dioxide has been shown to retard fungal rotting of fruits caused by a large variety of fungi

Cont...

- ✓ Ozone added to food storage to food storage environments has a preservative effect on certain foods

Food preservation methods

1. Control by heat

Methods of heat treatment of foods

- ✓ Pasteurization or low heat processing to destroy relatively heat sensitive microbes (in milk)

Cont...

- ✓ High heat treatment
- For high acid or low pH (pH < 4.6) products such as tomato, fruit products and acidified foods (pickles), use100^{o}C heat

2. Low temperature control

Methods

- ✓ Ice chilling between 0 - 1°C for fish, meat, cut fruits and vegetable salads

Cont...

- ✓ Refrigeration at 4 - 5°C for many foods
- ✓ Freezing: home freezers at – 20°C; dry ice (solid carbon dioxide) at – 78°C

3. Control by reduction of water activity

Methods

- ✓ Sun drying – grains, fruits, vegetables, fish, meat
- ✓ Mechanical means like:

Cont...

- Tunnel drying – food travels through tunnel against flow of hot air
- Roller drying – liquid food applied thinly on heated roller
- Spray drying – liquid food sprayed as small droplets and dried by hot air
- Smoking – for meat and fish; low heat (63°C) and smoke

Cont...

4. Control by antimicrobial preservatives

- ✓ **Chemicals:**

- Nitrite (Na or K salts) – 200 ppm for heat-processed meat, poultry and fish
- Sulfur dioxide (SO_2) and sulfite (SO_3^{2-}) – 200 to 300 ppm for soft fruits, fruit juices
- Glycerol monolaurate (monolaurin) – up to 500 ppm against anaerobic bacteria

FOOD AND DRINKING ESTABLISHMENTS







What is a food and drink establishment?

- ✓ Are places where food and drink is prepared in large quantities for public consumption.
- ✓ Are also called food catering establishments.
- ✓ Food & drink establishments have a legal and moral responsibility to provide safe food and drink to the consumers.

Types of food and drinking establishments

- ✓ According to USA FDA divided into 3:

1. Establishments open to public patronage
   - These are establishments open to the public at large all the time.
   - Commercial establishments (Restaurants, cafes, fast food outlets, bars, hotels)
2. Establishments offering semi- public food service
   - These are food establishments that give service to persons to whom other eating facilities are not available
   - Health institutions, educational institutions, prison institutions and industrial plants
3. Establishments providing a limited type of food service
   - Private clubs, fraternal orders, various societies, churches and religious affiliated organizations where service is provided to their members only

Categories of FDEs

- There are several types of FDEs based on the service they are providi
  - Restaurants
  - Cafés
  - Grocery
  - Bakery
  - Hotel
  - Butcher shop
  - Tea houses
  - Tej bet
  - Areki bet







Hygienic requirements of FDEs

1. Licensing
   - ✓ There should be a system for licensing FDEs
   - ✓ *Woreda* health office is responsible
2. Location

- The FDE should be:
  - ✓ Well away from any source of hazards (marshy areas, waste disposal sites and flooding).
  - ✓ Conveniently accessible to staff and consumers.
  - ✓ At a distance from public institutes such as schools and health facilities.
  - ✓ Access to clean air and natural lighting

Hygienic requirements of FDEs

3. Sanitary facilities

I. Adequate & wholesome water supply from approved source
- Hot and cold running water
- Ice should be prepared from water of drinking quality

II. Adequate toilet and lavatory facilities for customers & workers
- Conveniently located and accessible
- Separate showers for males and females
- Proper toilet seats which are easy to clean and urinals
- Toilet not near and not opening to dining rooms or areas where food is prepared
- Proper wash hand basins with soaps
- Toilets having self- closing doors (if possible)
- Hand drying facility(preferably machine otherwise towel)

Hygienic requirements of FDEs

III. Proper waste collection and disposal systems

- Properly drained
- Washable, easy to clean and convenient to handle waste containers(dust bins) with proper covers
- Wastes should be properly collected and disposed

IV. Proper plumbing connections(water & WW)

- Properly installed and maintained
- Proper types (non-corrosive or rusting types)
- No cross- connection of water and waste pipes

V. Proper insect & rodent proofing and control methods

VI. Keeping cleanliness of floors, walls and ceilings

Hygienic requirements of FDEs

VII. Adequate utensils of sanitary standard
VIII. Proper ventilation of all rooms

IX. Proper lighting of rooms, work areas, toilets

X. Dressing rooms together with lockers

XI. Properly trained, hygienic, and healthy food handlers

Recommended equipment and utensils

- Food equipment and utensils should comply with the following sanitary requirements:
  - ✓Should be of good repair and with no cracks
  - ✓No chips, pits or open seams that can hold microorganisms
  - ✓Should be smooth and easily cleanable
  - ✓The equipment and utensils should be of approved material
  - ✓Cause no corrosion or rusting

Dish Washing in FDEs

- ✓ It has its own procedure and should be followed.
- ✓ Dish - plates, cups, glasses, spoons, forks and other utensils.
  - Significance of effective dish washing

1. Health aspect
   - Health vs disease: dishes may serve to transmit many diseases if they are not cleaned
   - Aesthetic reason: people like to be served with clean utensils
2. Economic aspect
   - The consumer may refuse to eat or pay food served with unclean dishes

Dish Washing in FDEs

- ✓ Two methods of dish washing:
  1. Manual - done by hands
  2. Mechanical - done by machine
- ✓ Two accepted dish washing systems:
  1. The three compartment
  2. The two compartment







Dish Washing in FDEs

- Essential steps in dish washing

1. Get ready wash materials and equipment
   - Clean sinks or vats of 2 or 3 compartment
   - Hot wash water(43°C to 49°C)
   - Detergent or soap
   - Scraper
   - Garbage can
   - Drying racks
   - Sanitizing chemicals(disinfectants)
2. Scrap the dishes
3. Wash the dishes in compartment one
   - Wash each dish separately

Dish Washing in FDEs

4. Rinse the dishes washed in compartment two
   - This helps to remove soap or detergent retained while washing at compartment one
   - Rinsing is done by dipping repeatedly the dishes in warm clean water

5. Sanitize the dishes in compartment three
   - ✓ To ensure the dishes are free of pathogenic organisms and the total bacteria count is also highly reduced
   - ✓ The procedure is performed by immersing the articles in hot water(77°C) or in a disinfectant solution such as Cl

6. Dry the sanitized articles in air

7. Store appropriately the sanitized dishes

8. Clean the vats

Dish Washing in FDEs

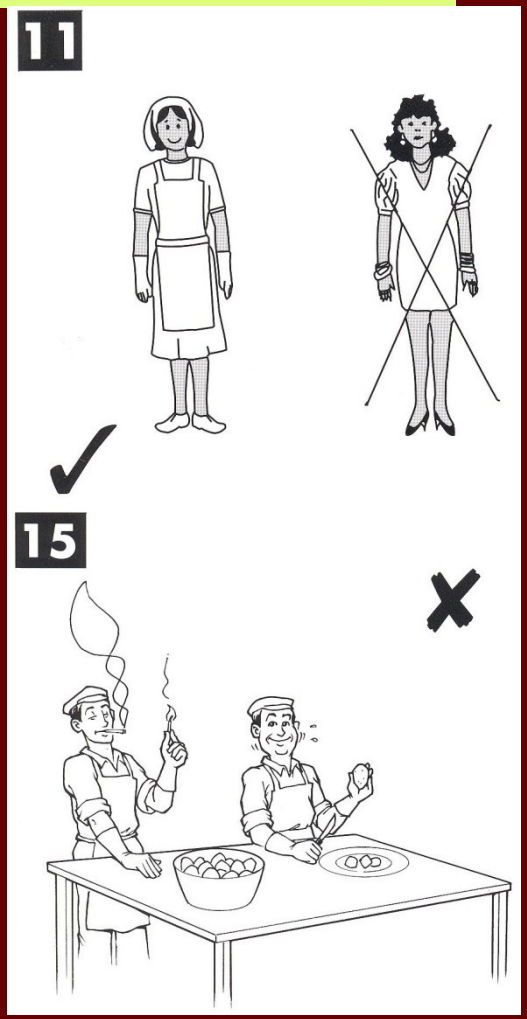
Factors affecting cleaning performance

- **T**ime: contact time on the surface being cleaned
- **A**ction: physical force exerted on to the surface
- **C**oncentration: amount of cleaner used
- **T**emperature: temperature of the cleaning water
- **N**ature: composition of the dirt
- **S**urface: nature of cleaned material

Food handlers' health and hygiene

- ✓ **Food handlers are a common source of food borne diseases.**
- ✓ The practice of good personal hygiene is essential for anyone who handles food.
- ✓ A **sick food handler** with symptoms of **diarrhoea**, eye and ear discharges, **skin infections**, open cuts and wounds, or coughing should be excluded until full recovered.

Food handlers’ health and hygiene



moking in kitchens



Sanitary Inspection of FDEs

- ✓ Is a set of activities concerned with the preservation of public health and the investigation of environmental hazards in food establishments.

Purpose of Inspection

- ✓ Sanitary inspection aims to investigate and detect:
  - → Food spoilage and its sources
  - → **Food contamination and its sources**
  - → Provision for hygienic procedures (dish and hand washing, food storage)
  - → Provision of sanitary facilities (latrine, water, shower, hand washing)
  - → **The proper location of the establishment**
  - → **The hygienic practice of food handlers**
  - → Proper waste management (storage, collection and disposal)
  - → The presence of vectors

Sanitary Inspection of FDEs

Types of Inspection

1.Initial/complete inspection

- ✓ This is a detailed type of inspection, which should be made when a property or establishment is **first brought under department control** to determine compliance with the law of the government that regulates food and drinking establishments.

2.Routine inspection

- ✓ These are usually **regular inspection** of establishments based on a field inspection form to determine compliance with sanitary rules and regulations

Sanitary Inspection of FDEs

3. Re-inspection

- ✓ A re-inspection would be made as a follow up on routine inspection, particularly when significant violations are noted to determine whether the needed correction have been made.

- Two forms of inspection:

I. The planned form: this is the programmed and routine type

II. The unplanned form: this is incidental, occasional or urgent type made based on call, information of an out break

Sanitary Inspection of FDEs

Preconditions for the inspection of FDEs

- **Inspection should be purposeful**:
  - ✓ To educate and persuade to monitor faults and to prevent the occurrence of food borne diseases
- **It should be legal**
  - ✓ An inspector should be licensed and carries the proper identification card and official letter of authorization
  - ✓ Inspections should involve as a committee representatives of the concerned legal authorities and offices such as the police, local administration and the municipality in order to facilitate good legal ground and backing
  - ✓ Inspections initiated after the proper polite introduction with the responsible management of the establishment

Sanitary Inspection of FDEs

Preconditions for the inspection of FDEs

- **All establishments inspected with equal considerations under the law**
- Inspections supported with a checklist besides to onsite observations of situations
- The presence of **legal, original and timely work license should be checked prior to starting inspection**
  - ✓ Unlicensed establishments should be reported to the responsible authorities for action

Sanitary Inspection of FDEs

Preconditions for the inspection of FDEs

- **Observations and findings recorded in duplicate**, discussed with the management of the establishment, signed by the inspector, the responsible management and subordinate observers present.
  - ✓ The copy should be left at the establishment with the proper recommendations and suggestions for correction and improvement
- Any actions of punishment should correspond to legal procedures
- All precautions considered when closing an establishment

Chapter 5: Vector control

Learning Objectives

At the end of this chapter, the students are expected to:

- ✓ Define the terms
- ✓ Be aware of existing public health problem
- ✓ Discuss about ways of disease transmission
- ✓ Know the arthropods and their identification
- ✓ Know the advantages and disadvantages of arthropods
- ✓ Be aware of public health importance of vectors

Introduction

Definition of terms

Entomology: - is a science that deals with **the study of arthropods** in general, and touches sciences like zoology, biology, Parasitology and microbiology.

Arthropods:

- ✓ These are invertebrate animals with jointed legs and identified by their specific characteristics.

Cont...

- Arthro = jointed
- Poda = legs

Rodents

- ✓ This comprises a **great number of mammals**, ranging in size from the rats and mice to as large as the porcupines and which belong to the order rodentia.

Cont...

Vector(s): - are arthropods or other invertebrates which **transmit infection by inoculation into or through** the:

- skin or mucous membrane by
  - biting, or
  - **deposit of infective materials** on the skin or on food or other objects

Cont...

Host

- ✓ **Definitive host** (Permanent host):
  - ✓ Sexual stage :Mosquito for plasmodium
- ✓ **In definitive** host (Intermediate host): asexual stage
  - Human being

Existing public health problem

- ✓ **Disease transmission**: Sever Morbidity and Mortality due to vector born diseases
  - Example Malaria
- ✓ **Food and material destruction**
- ✓ Annoyance
- ✓ **Food source**, Honey Bee

Cont...

Problems regarding the control of vector born diseases

- 1950's & 1960's
  - Control and eradication of the most important disease vectors by large scale application of DDT.
  - However success was short lived due to
    - the development of **physiological resistant** of the vectors to the pesticide applied
    - **Persistence**

Global warming impacts vector-borne diseases

- ✓ Changes in temperature will affect their development, reproduction, behavior and survival rates.
- ✓ May shift the geographic range/ expansion in which they can live and the seasonal period of disease risk.
- ✓ **Temperature** can also affect pathogen development within vectors
- ✓ **Precipitation** can influence the availability of breeding sites,

Cont…

- ✓ climatic variables can affect the distribution and abundance of their vertebrate host species
- The above factors coupled with
  - **Decreased resources for surveillance**
  - **Deterioration of public health infrastructure** required to deal with the vector thereby the diseases
  - **Unprecedented population growth**

Cont…

- Uncontrolled urbanization
- **Change in agricultural practice**
- Deforestation

General control option

- ✓ Generally control measures relay on targeting the arthropod vector
- ✓ **Environmental management**
  - Prevent the vectors from having breading and resting place

Cont...

- ✓ Physical barriers
- ✓ **Chemical and biological control measures**
- ✓ Prevention of vectors and diseases importation
- ✓ Control measure that focus to the agent itself
- ✓ Integrated vector control measures

Ways of disease transmission

1. Vertical transmission/Trans-Ovarial transmission
   - Example
     - **Sand fly fever**
     - **Tick- borne relapsing fever**
       - The disease is kept alive in the tick reservoir from generation to generation by infection of the tick egg.

Cont...

- The young ticks emerging from the eggs are infected.
- In due time they will develop to maturity and transmit the disease to their offspring via the egg

2. Horizontal Transmission

a**. Mechanical disease transmission**: House fly and Coachroach as a mechanical vector for Amoebae, Giardia

Cont...

b. **Biological transmission**

- Cyclo-propagative
  - **Cyclical development and multiplication in the body of the vector**
  - Malaria parasites in female Anopheles mosquitoes
- Propagative
  - **Multiplication** but no cyclical changes

Cont...

- *Yersinia pestis* in fleas

– Cyclo-developmental

- cyclical development but no multiplication

Arthropods and their Identification

Common identification characteristics of arthropods

1. Exoskeleton

– Epidermis secretes an external skeleton called the exoskeleton

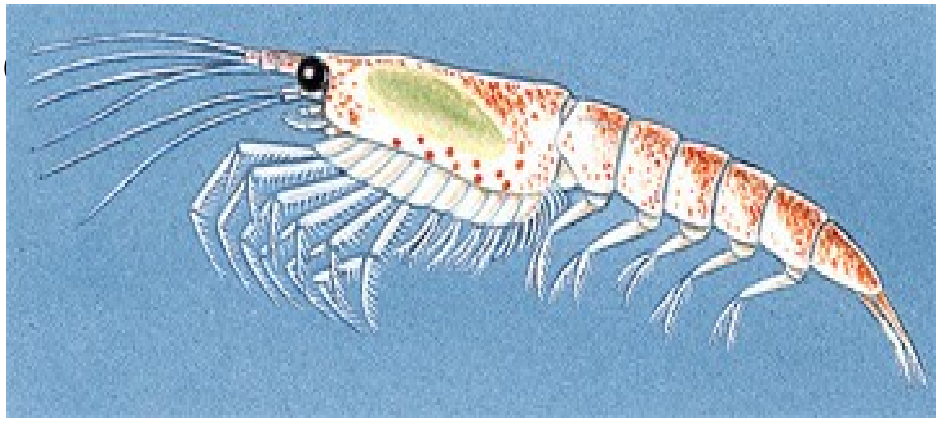
Cont...

- Advantages of possessing an exoskeleton:
  - Provides **strong support and protection**
  - serves as a **barrier to prevent internal tissues** from drying out; important because many arthropods live on land
  - serves as a **barrier to prevent infection**
  - made up of cuticle that contain chitin (Nitrogenous polysaccharide).

Cont...

- Chitin is a tough and rigid substance.
- It is **water proof, parasite proof, shock proof and do not dissolve with acid**

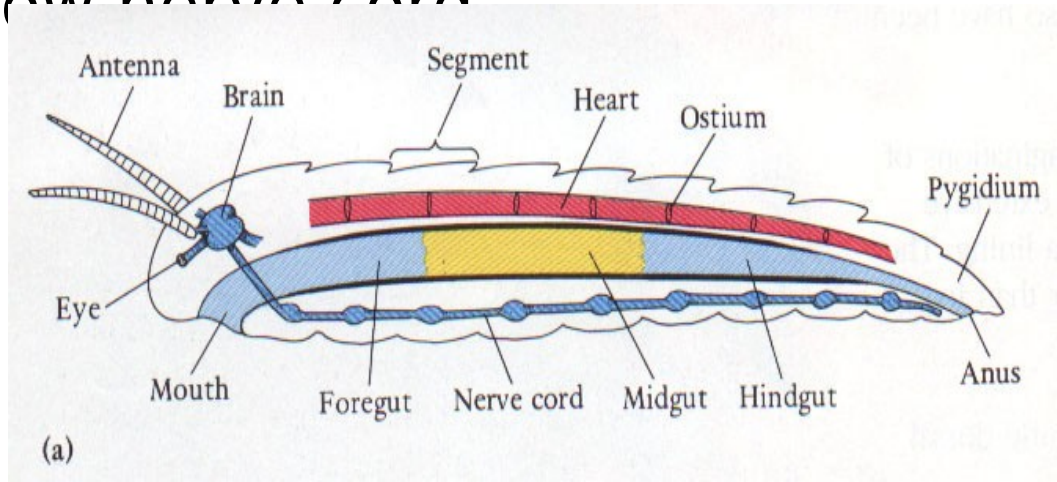
2. Segm



Cont...

3. **Ventral nerve chord**: as opposed to a vertebrate nerve chord which is dorsal

Arthropods have a well-developed nervous system with anterior brain and a double, ventral hollow nerve cord



Arthropod habitat

- ✓ **Are found almost every where**
- ✓ Are adopted and can be found in a greater variety of habitats than any other type of animals:
  - on top of mountains
  - at great depths in the ocean
  - salinity
  - great extremes of temperature
  - toxicity
  - acidity
  - in the icy wilderness of Antarctica

Cont…

Diversity: Why arthropods are so successful?

- ✓ They can adapt to even **harshest living conditions**
- ✓ Their small size
- ✓ **possession of exoskeleton**
- ✓ Most insects have wings
- ✓ **Special powers of reproduction**
  - high reproductive rate
  - longevity

Cont...

- lay many eggs
- Many kinds produce several generations during a season

Arthropod species abundance

- ✓ Arthropods are the largest group of animals, comprising **over 1,000,000 terrestrial and aquatic species**
- ✓ It is the largest of all animal phylums and

Cont...

- ✓ Accounts for over **three quarters of all currently known living and fossil organisms**.

Advantages and disadvantages of arthropods

Advantages of arthropods

- They are fundamental part of our ecosystem
- **Pollination**
- Decomposition of organic materials

Cont...

- **Facilitating the recycling of carbon**, nitrogen, and other essential nutrients
- The manufacture of useful products such as silk
- The direct production of certain foods

Disadvantages

- Eat our food
- **Contaminate our dwellings**
- Creating nuisance

Presentation for three group 20%

Content of presentation

- Physical characteristics of vectors.
- Difference between both sex.
- Public health importance.
- Prevention and control measures.
- Out of prevention and control measures which is the most effective measure.
- **Guest teacher will be assigned to evaluate you based on provided criteria.**

Public health importance of Vectors

Mosquitoes

- ✓ are insects belonging to the order Diptera
- ✓ they have two wings
- ✓ mosquito wings have scales
- ✓ have long segmented antennae
- ✓ long piercing, sucking proboscis
- ✓ Can be distinguished from other insects
    - Mouthpart-Proboscis
    - Scales

Cont...

Note

- ✓ Mosquitoes can be sexed by examining their antenna
  - Males-feathery antenna where as females possess short-invisible antenna
- ✓ Males are distinctly smaller than females and having no audible sound during flight

Cont....

Public health importance

1. Malaria

- Single-celled protozoan parasites
- Four species of malaria parasite infect humans
  - Plasmodium vivax
  - Plasmodium falciparum
  - Plasmodium malariae

Cont...

- Plasmodium ovale

– Malaria is a major public health problem in Ethiopia

- Every year it is the leading cause of outpatient consultations, admissions and death
- Malaria accounts for 20% of mortality among children under five years of age and 10% of the continent’s overall disease burden

Cont...

Prevention and control

- Use of ITN
- Residual sprays
- Epidemic prevention and control
- Integrated vector control strategy
- Environmental manipulation: eradication of favorable leaving env’t
  - Breeding sites

Cont...

- Resting areas
  - Draining
  - Filling
  - Proper disposal of empty Cans,...
  - Proper waste management, Culex mosquitoes

2. Black flies

Identification

- Adults are quite small, 1.5-4mm long
- When viewed from the side has a humped thorax.

Cont...

- Usually black in color but may have contrasting patterns of white, silvery or yellowish hairs on the body and legs
- Have a pair of large compound eyes which in female are separated on the top of the head, in males the eyes occupy almost all of the head .
- In males the small lenses are larger on the upper than low

Cont...

- Black flies are easily sexed by their eyes

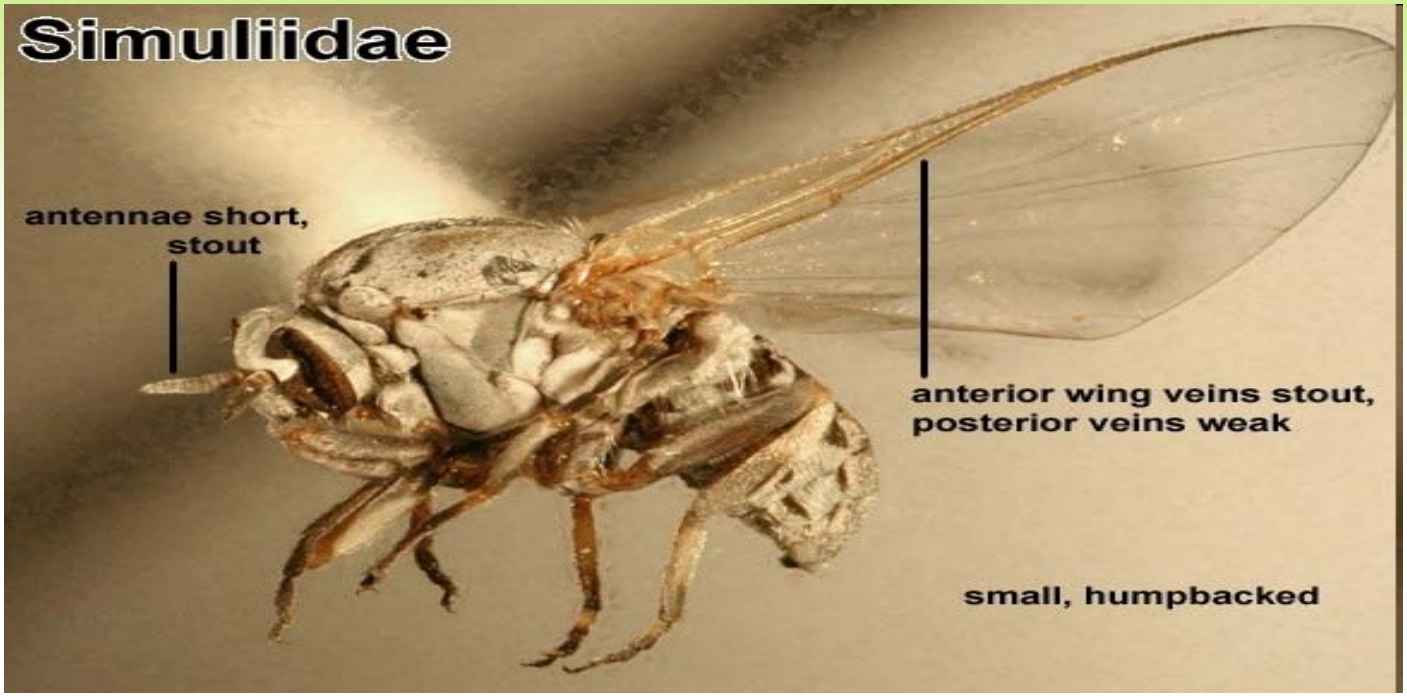


Fig. Adult black fly

Cont....

Adult

- After immergence adults immediately take flight
- Mass emergence of adults
- Both sexes feed on plant juice and natural secretions
- Only females bite
- Biting occurs outdoors at day time and many species seem active on cloudy and thundery weather

Cont...

- Different species prefer different body parts for Biting
  - Head, legs
  - Ears on animals, bite birds

Public health importance

a. Nuisance

- the bits of these flies cause localized swelling and inflammation accompanied by intense irritation lasting for several days

Cont…

b. Onchocerciasis/river blindness

- Repeated infection cause blindness
- The vector is found in South Western Ethiopia (Jimma, Bonga, Gore, Gardula, Lekemt)
- It is the world’s second leading infectious cause of blindness

Transmission: through the bite of female simulium spp

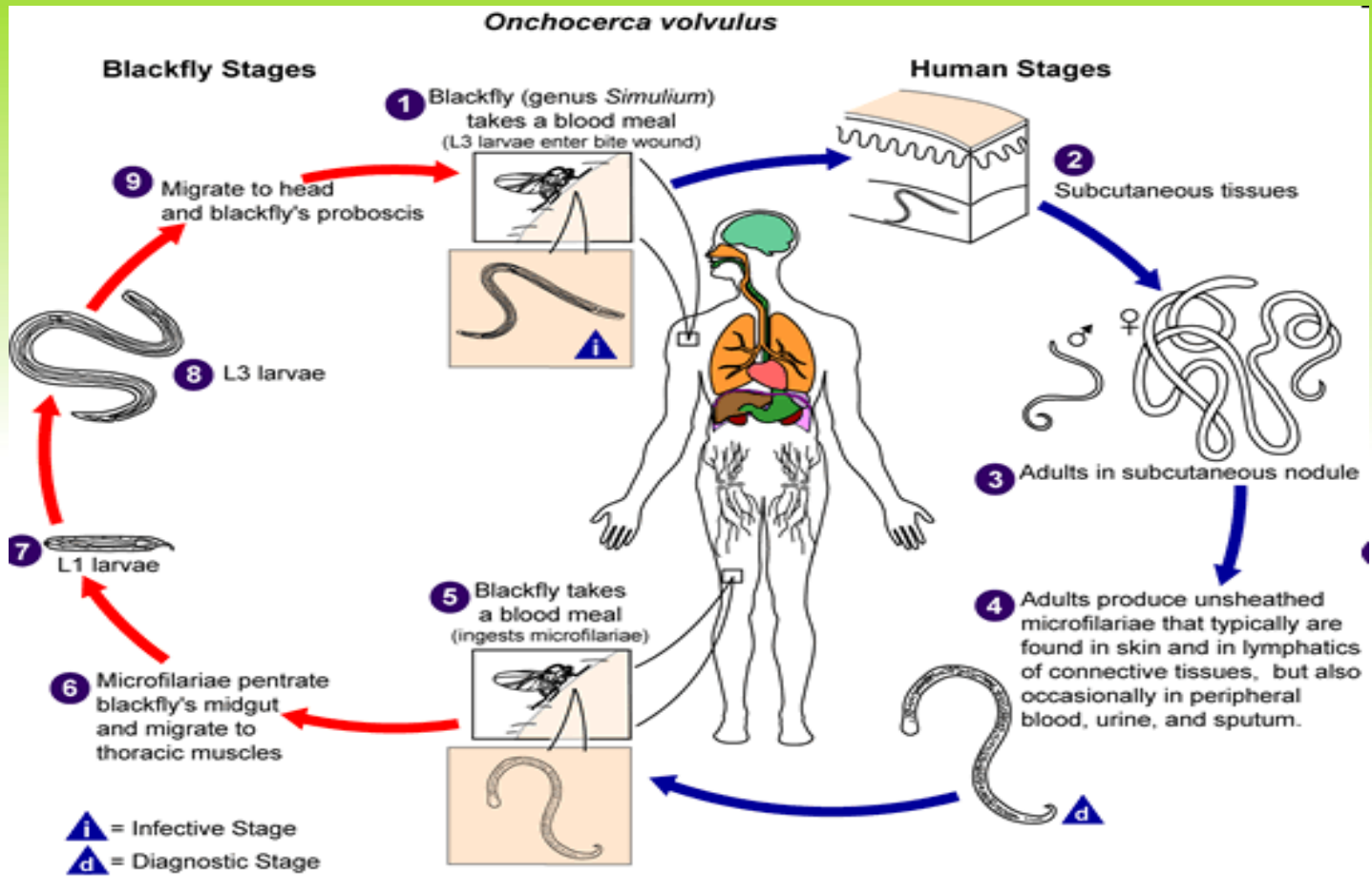


Fig. Life cycle of Onchocerca volvulus

Cont...

- The causative agent
  - Parasitic worm Onchocerca volvulus of the family Filariidae which lives in human body for up to 14 years

Prevention and control of Onchocerciasis

- Drug treatment: Ivermectin a single dose of drug needs to be taken annually
  - Adult worms die out in humans after 14 years

Cont...

- vector control
  - Aerial spray of Insecticide over the breeding sites in fast flowing rivers
  - Continues application of the insecticides from 15-30 minutes carried downstream, which may kill the simulids larvae
- DDT used to be an effective larval controlling mechanism

Cont...

- Now it is replaced by organophosphate such as temephos (Abate)

3. Tsetse flies

- **Identification**
  - Large (6-15mm)
  - Dark brown/ yellowish
  - Long, slender, forwarded and pointing proboscis

Cont...

- When at rest wings are closed one over the other and extended beyond the abdomen
- Have high pitch buzzing sound
- Occur in tropical Africa , south of the tropics of cancer

Adult behavior

- Live in a shady forest
- Both sexes feed on blood
- Bite at dusk and day and are Exophagic

Cont...

- Strong fliers 20mph
- Are attracted by large object, carbon dioxide and darkness
- Found in 30 countries with 45mile^2 area land is infected
- Create a great hindrance to animal population and agricultural development

Public health importance

- **Nuisance**
  - Painful bite

Cont...

- Disturbing sound

- **Human Trypanosomiasis**
  - Human African Trypanosomiasis/sleeping sickness
    - ✓Transmitted by
    - Parasitic protozoa:Four species
      - Trypanosoma vivax
      - Trypanosoma rhodesiense

Cont...

- Trypanosoma gambiense
- Trypanosoma congolense

- **Transmission**
  - Through the bite of both sexes
  - Mother to fetus transmission
    - Perinatal death

  -- Accidental infection

Cont....

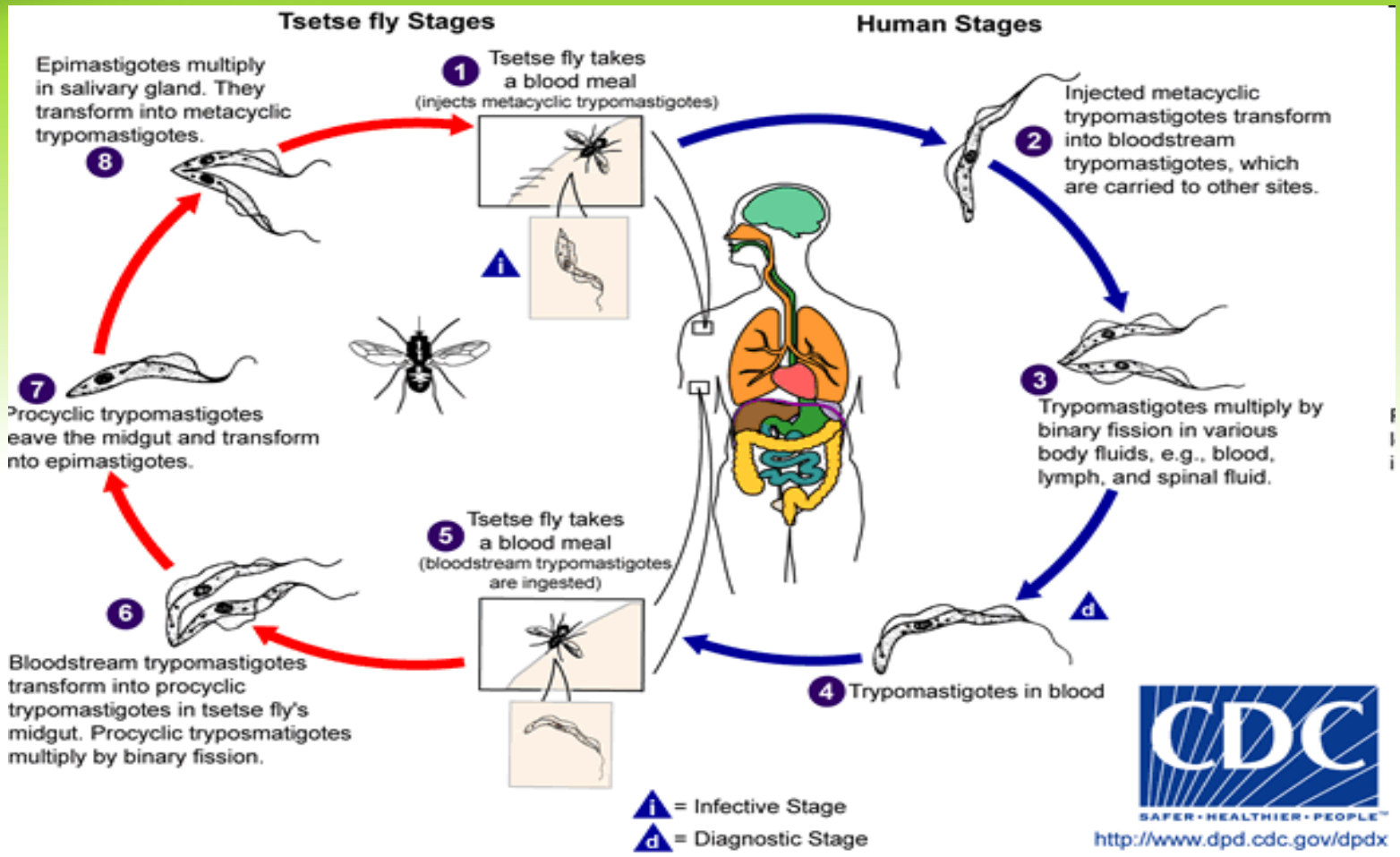


Fig. Trypanosomiasis life cycle

Cont...

Human African Trypanosomiasis/sleeping sickness

- ✓ **Two parasites are responsible**
- **T.b.rhodesiense**
  - Acute, sever, cause death within a few days/weeks
  - Occur in East and south Africa

Cont…

- Invasion of CNS, which may result mental deterioration, coma, and even death

- **T.b. gambiense**
  - Tends to progress very slowly and are less effective
  - Early symptoms
    - Itching

Cont...

- Later stage
  - Confusion, poor coordination, sensory disturbance, and disturbance of the sleep cycle
- If not treated it may cause fatality, and also it is irreversible

Prevention and control

- Reduction of Tsetse fly number/rhodesiense

Cont...

- Extensive clearance of bushes to destroy breeding site
- Wide spread application of insecticide and repellants
- 10-12 meters clearing of forest crossing roads
- Closing highways of Tsetse infested areas
- Trapping adults using nets or odor attractant immersed traps

Cont...

- Killing pupa
- Use animals bait/visual target to trap
- Inspection of people and treating of cases
- Genetic control: sterilize males using radiation

❖ **Rodent problem and infestation (Reading Assignment)**

Chapter 6:Residential and Institutional Health

Learning Objectives

At the end of this chapter, the students are expected to:

- ✓ Define the terms
- ✓ Be aware of health importance of housing
- ✓ Discuss about basic principles of healthful housing
- ✓ Know the health of institution

Introduction

Definition of terms

- **Residential environment** is the physical structure that *man uses for shelter* and the environs of that structure including:
  - all necessary services,
  - facilities,
  - equipment and devices needed or desired for the physical and mental health and social well-being of the family and individual.

Cont...

- This will include the :
  - residential building,
  - immediate surroundings,
  - neighborhood, and
  - community (WHO)

✓ **Standard housing** is a house that is properly **planed** and **constructed**, **comfortable, safe to live** in and fulfill the basic housing necessities.

Cont...

- In other words, it is comfortable dwelling that satisfies the definition of housing

✓ **Sub-standard housing** is a house that is poorly sited, planed, constructed, maintained, and does not in general comply with the more important sanitary facilities.

Or **reverse of standard housing.**

Cont...

- ✓ **Institution** is a complete property with building, facilities, and services having a **social, educational, or religious purpose.**
- E.g. Colleges and universities, schools, hospital, jails and prisons

Health importance of housing

- ✓ **Communicable disease**
- Although there is no specific disease for which poor housing is a known and single cause, there is perceived real association between poor health status and living in sub-standard house.
  - Mortality due to communicable disease is 65% higher among residents of poor housing compared to those who live in healthful housing

Cont...

- The prevalence of intestinal disease is 100% higher in population living in homes that lack private latrine
- Literatures show some of the symptoms of mental health such as:
  - stress,
  - irritability,

Cont...

- depression,
- social misconduct and alteration of attention capacities at schools in children may be related to bad housing conditions

✓ **Social importance**

- People living in slum area usually face social problems such as:
  - **inferiority** and
  - resentment against those who are in better position

Cont...

- ✓ **Indoor air pollution**
- It occurs through enrichment of indoor air with noxious gases, dust, bacteria, fungi, solvents, and other undesirable substances.
- It is mainly caused by an insufficient and smoky fuels burned for cooking and heating.

Cont...

- Exposure to these pollutants causes disease like:
  - bronchitis,
  - predisposing factor for tuberculosis and
  - asthma, etc.

✓ **Home accidents**

- Poor design, construction, installation of materials, arrangement of facilities, and maintenance can expose to home accidents like:
  - explosions and fires or their spread,

Cont...

- electrical hazards, including shocks and burns, hazards of falls,
- slipping, and
- tripping.

✓ **Noise pollution**

- Noise is becoming recognized as a major community pollution problem.

Cont…

- People have to use **buffer zones** by:
  - planting trees,
  - erect walls or
  - **leave open space between living quarters** and noise generating structures.

Basic principles of healthful housing

✓ Even though the reality is different i.e. the need of a proportion of the population for shelter and basic services are not meet in all countries,

Cont...

- ✓ there is still a need to create a living condition which satisfy the basic needs of inhabitants.

1. Satisfaction of fundamental physiological needs

- A thermal environment to ***avoid undue*** **heat loss and** ***permit adequate*** **heat loss**
- The lack of adequate heating and cooling systems in homes can contribute to respiratory illnesses or even lead to death from extreme temperatures

Cont…

- An atmosphere of “reasonable chemical purity”
- Provision of:
  - Adequate ***daylight* illumination** and avoidance of undue daylight glare;
  - **Direct sunlight**; and
  - Adequate *artificia*l illumination and avoidance of glare

Cont...

- Provision of adequate space for exercise and for the play of children:
- Healthful housing should include the provision of safe play and exercise areas

2. Satisfaction of fundamental psychological needs

A. Privacy

- Privacy is a necessity to most people.

Cont...

- Ideally, everyone would have their own rooms excepting married couples and small children(1-10 age)
- Health full housing should include:
  - sufficient bed rooms and
  - bathrooms.
- **Crowding** can lead to poor school performance in children

Cont...

- Provision of facilities
  - To make performing household tasks possible without undue physical and mental fatigue;
  - For “the maintenance of cleanliness of the dwelling and the person”; and
  - “For reasonable esthetic satisfaction in the home and its surroundings”

Cont...

B. **Security**

- Residents should be secured from:
  - robbers,
  - wild animals and
  - other conditions which can cause scary situations.

3. Protection against communicable disease

1. **Dampness**

- It includes the presence of water damage, damp stains, visible mould and condensation

Cont...

2. **Water supply and waste management**

- Provision of safe and adequate water supply to the dwelling and proper waste management

3. **Overcrowding**

- Many health problems affecting the poorer group are associated with overcrowding; they include:
  - household accidents,

Cont…

- air born infection,
- acute respiratory tract infection,
- pneumonia, and
- tuberculosis.

- Poorer groups live in overcrowded condition.
- The **average person per room is between 2 and 3.5 i**n most developing countries, as against **0.5 to 1** in most developed countries

Cont...

- The environment in and around human dwelling offers an important habitat for:
  - a wide range of disease vectors which are highly involved in the disease transsmition.

4. Protection against fire and accident injuries

- The health problems linked to unsafe or dangerous building structure include:
  - increased risk of fire,

Cont...

  - building collapse, and
  - electrocution from faulty wiring

- Much **urban and rural housing** in developing countries is constructed of:
  - **flammable materials** (wood, cardboard, plastics, etc)

Cont...

- Therefore the risk of fire is extremely high where open fire or mobile stoves are used for cooking and candles or paraffin lamps for heating
- Household accidents, including burns and scalds, are very common in overcrowded condition.
- Injuries from falls are common in substandard housing and in settlements with no all-weather roads or paths or sites of steep slops.

Cont...

5. Protection against excessive noise

- Noise is common nuisance in everyday life and can give rise to serious health problems.
- **Hearing loss** is perhaps the best known and the most insidious, and is not uncommon as a result of occupational exposure.

Institutional Health: School, prison and hospital health program

1. Components of school health program

- ✓ **A healthful school environment**

- The first component, a healthful school environment, promotes a healthful **physical and emotional environment.**
- It is important that schools are safe and secure for all those who attend and work there

Cont...

- This component includes:
  - issues regarding safety,
  - school security,
  - a school's emotional and
  - social atmosphere, the physical environment, and sexual harassment.

Cont...

- ✓ **School health services**
- The second component, **school health services**, encourages promoting and protecting the health of every child.
- This may include:
  - on-site health clinics,
  - school nurses,
  - school physicians, and

Cont...

  - providing immunizations and screenings for vision, hearing, healthy weight, and head lice.

- With clinics and medical professionals located in schools, students have the opportunity for convenient medical care.
- Many clinics provide both treatment and educational services.
- For families who cannot afford medical care, this may be their only means to health care.

Cont…

- ✓ **Physical education**
- The third component, **physical education**, promotes regular exercise in schools as part of a healthful lifestyle.
- Physical education is important to develop strength and improve body image.
- ✓ **Provision of nutrition Services**
- The fourth component, nutrition services, encourages balanced, appealing, and varied meals and snacks for students.

Cont...

- Good nutrition is importance to prevent future illnesses
- ✓ **Health education**
- The major content areas suggested for instruction are:
  - community health,
  - consumer health,
  - environmental health,

Cont...

- family life,
- mental and emotional health,
- injury prevention and safety, nutrition, personal health prevention, control of disease, and substance use and abuse.

- The individual states and local districts decide the actual content to be taught.

Cont...

- Teachers are encouraged to teach healthful behaviors and provide students with skills to live healthier lives.

✓ **Location and space requirement of the school:**

- Where and how schools are built will profoundly affect the communities they serve and the quality of their air and water.

Cont...

- Some of the factors that can directly impact the health and well-being of:
  - children,
  - staff and the broader community include:
    - potential air, soil and water contamination on school sites;
    - traffic and busing requirements that affect ambient air quality;

Cont...

- safe walking which affect opportunities for physical activity; and
- play spaces and sport facilities that also influence opportunities for physical activity

✓ **Sanitary facilities**

- Very often the sanitary facilities in schools are in a rather poor condition, in some cases they even do not exist.

Cont...

- Toilet facilities
  1. Water carriage system
     - One seat/ 40 boys and one seat/ 35 girls for elementary,
     - One seat/ 70 boys and one seat/ 45 girls for secondary
  2. Non-water carriage system
     - 1 seat of pit latrine /60-90 boys
     - 1 seat of pit latrine /30-45 girls
- Urinals: 1/30 boys
- Lavatory: 1 hand washing basin /50 students

Cont...

- Note :Please be aware these are minimum requirements; more fixtures or toilet rooms may be required to adequately serve students and staff in some facility layouts

2. Prison Health

- The physical structure
  - Building should be structurally sound, secures and fire resistant and properly heated, ventilated and lighted.

Cont...

- Cleanliness and maintenance
  - Essential to maintain the health and morale of the inmates as well as to provide protection for the community against the spread of disease that might originate with the inmates.
- Examination of inmates and inspection
- Examine all inmates regularly

Cont...

- Water supply and sewerage
  - Safe and adequate water supply
  - Shower
- Pest control
- Cell furnishings: each cell or dormitory should be equipped with a metal bed, linen, blankets, matters pillows, chairs, tables, lockers for personal belongings.

Cont...

- 1 shower/ 15 inmates
- 1 W.C and 1 lavatory for each of prisoners
- 50 sq ft of floor space for each prisoner

3. **Hospital health programs**

- Hospitals are health institutes which gives health services and house large numbers of people who are sick and whose immune systems are often in a weakened state and render different services.

Cont...

- However, less care, poor sanitation and various limiting factors in the hospital environment have become a means of:
  - introducing contaminants and
  - infectious agents (bacteria and virus) to the hospital environment creating a risk of health problems to the workers, patients and visitors.

Cont...

- ✓ **Nosocomial infections**
- **a**re infections which are a result of treatment in a hospital or a healthcare service unit, but secondary to the patient's original condition.
- Infections are considered nosocomial if they first appear 48 hours or more after hospital admission or within 30 days after discharge.

Cont...

- **Prevention and control measures**
- Generally all workers in the hospital environment can get exposed.
- But there are some gropes like cleaners or house keepers, nurses, workers in dietary section, and central supply who are at high risk of health problems.
- The following methods of prevention can be applied to minimize the problem.

Cont...

1. Reducing person-to-person transmission

- Hand decontamination
- Personal hygiene
- Clothing
- Masks
- Gloves
- Safe injection practices

2. Preventing transmission from the environment

- Cleaning of the hospital environment
- Use of hot/superheated water for cleaning
- Disinfection of patient equipment

Cont...

- Sterilization

3. Proper disposal of wastes generated in the hospitals and other health institutes

4. Formation of infection control committee

- Controls the overall situations that could give rise to hospital acquired infections

❖ Zoning and town planning(reading assignment)

THANK YOU

Chapter 7: Occupational Health and Safety

Learning Objectives

At the end of this chapter, the students are expected to:

- ✓ Define the terms
- ✓ Know the importance of occupational health and safety
- ✓ Discuss about scope of occupational health and safety
- ✓ Know the categories of occupational hazards
- ✓ Be aware of the evaluation of occupational risk
- ✓ Be aware of occupational disease
- ✓ Know the methods of control

Introduction

Definition of terms and concepts

- **Occupational health** is defined as that science and art devoted to the:
  - anticipation,
  - recognition,
  - evaluation and
  - control of those environmental factors or stresses, arising in or from the place of work, which may cause illness impaired health and well being

Cont...

- **Industrial hygiene** has been described as the “promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations

What is occupational health and safety?

- Occupational health and safety is a discipline with a broad scope involving many specialized fields.

Cont...

- In its broadest sense, it aims at:
  - The promotion and maintenance of the highest degree of physical, mental and social well- being of workers in all occupation;
  - The **prevention** among workers of adverse effect on **health** caused by their working conditions;
  - The protection of workers in their employment from risks resulting from factors adverse to health;

Cont...

- The placing and maintenance of workers in an occupational environment adopted to physical and mental needs;
- The **adaptation of work to humans**

- In other words occupational health and safety encompasses the:
  - social,
  - mental and
  - physical well-being of workers that is the “whole person”

Cont...

- Successful occupational health and safety practice requires the collaboration and participation of both:
  - **employers** and
  - **workers** in health and safety programmes

Importance of occupational health and safety

- Work plays a central role in people's lives, since most workers spent at least **eight** hours a day in the work place.

Cont...

- Therefore, work environment should be safe and healthy.
- Yet this is not the case for many workers.
- Every day workers all over the world are faced with a multitude of health hazards, such as;
  - dusts, gasses, noise, vibration, extreme temperature, etc.

Cont...

- Unfortunately, some employers assume little responsibility for the protection of workers' health and safety.
- In fact, some employers do not even know that they have the moral and often legal responsibility to protect workers.

Cont...

- As a result of the hazard and a lack of attention given to health and safety:
  - work-related accident and
  - diseases are common in all parts of the world.

Scope of occupational health and safety

- Recognition and anticipation of workers health problems in an industrial atmosphere

Cont...

- Evaluation of the recognized problem which encompasses mainly:
  - data collection,
  - analysis,
  - interpretation, and recognition
- **Development of corrective actions to eliminate or limit the problem**

Cont...

- Generally, the work frame of industrial hygiene is wide and needs multidisciplinary approach.
- It requires the knowledge of physics, biology, chemistry, ergonomics, medicine, engineering and related science.
- It also requires public health management skills for proper communication and decision making.

Categories of occupational hazards

- To be effective in recognizing and evaluating on-the-job hazards and recommending controls, Environmental health officers must be familiar with the hazards characteristics.
- Some common hazards that may be in the workplace include:
  - Chemical hazard
  - Physical hazard
  - Biological hazard
  - ergonomic hazard
  - psychosocial hazard

1. Chemical Hazards

- Comprise the largest group by far.
- These include :
  - asbestos,
  - coal dust,
  - multitude of acids and alkalis,
  - gases such as SO_2, CO_2, CO, NO_x,
  - heavy metal poisonings such as lead and mercury
  - pesticides,
  - solvents and preservatives.

Cont...

- These harmful chemical compounds in the form of :
  - Solids, liquids gases
  - mists, dusts, fumes, and vapor
- exert toxic effects after they get entrance by inhalation, absorption through direct contact with skin or ingestion.
  - The most important of these is inhalation due to the speed with which toxic substances are absorbed and enter the blood stream.

Cont...

- N.B The degree of worker risk from exposure to any given substances depends on the nature and potency of the toxic effects and the magnitude and duration of exposure.

2. Biological hazards

- These include bacteria, virus, fungi, and other living organisms that can cause acute and chronic infections.

3. Physical hazard

- Non-ionizing radiation e.g. microwaves, infra red, visible and ultra-violet light
- Ionizing radiation e.g. X-rays, gamma rays, beta particles, alpha particles from radon daughters
- Noise (usually measured in decibels dB) and vibration;
- Temperature, humidity etc.

4. Ergonomic

- The term is originated from two Greek words, ergon- meaning **work** and **nomos** meaning law.
- It is, therefore, the study of **law (s) governing work and its environment.**
- It includes human factors in engineering and it deals with the:
  - consideration of human characteristics,

Cont...

  - expectations and behaviors in the design of tools, equipment etc that people use in their work and every day lives and the environment in which they work and live.

- Ergonomics related injuries and illness are ranging from eyestrain and headaches, musculoskeletal ailments such as chronic backache, neck and shoulder pain, etc

Cont...

- These and other related problems are avoided primarily by :
  - the effective design of a job or jobsite and
  - better- designed tools or equipment that meet workers needs in terms of physical environment and job tasks

5. Psychosocial hazard

- The term “stress” means the strain imposed on the worker by psychosocial influences associated with urbanization and works.
- Within the work environment itself, emotional stress may arise from a variety of psychosocial factors:
  - which the worker finds unsatisfactory, or
  - frustrating or demoralizing for example,

Cont...

- Workers may be working in shifts that will expose them to unusual hours.
- They may upset their family's life as a result of their work conditions.
- Workers may be working with a person who is paid more but who is incapable of working
- Financial incentives are too low, Work over load, work under load, poor job management, career development, and lack of job security, etc.

The Health effects from psychosocial hazard:

a) **Psychological and behavioral changes** including hostility, aggressiveness, anxiety, depression, tardiness, alcoholism, drug abuse, sickness absenteeism

b) **Psychosomatic ill health-** including fatigue, headache, pain in the shoulder, neck and back pain, propensity to peptic ulcer, hypertension, heart disease and rapid aging

Evaluation of Occupational Health Risks

Evaluation of occupational health risk at least consists the following five phases

- **Preparation**
- **Calibration**
- **Sampling and monitoring**
- **Analysis of samples**
- **Interpretation of Results**

1. Preparation includes:

- Obtaining information on the stress and arrange for the monitoring
- Find a sampling method capable of measuring the contaminant as reflected and required by the exposure limit

2. Calibration:

- Calibrate sampling devices according to the prescriptions

3. Sampling and monitoring types:

- Decide on the types and numbers of samples
- ✓ **Sampling** is a process consisting of the withdrawal or isolation of a fractional part of a whole
- In occupational health the taking of a sample is usually to determine the extent or magnitude of the environmental stresses

Cont…

- When taking sampling to determine the magnitude of an environmental stress, the surveyor must attempt to reduce inaccuracies and errors

Some of the **factors to be considered** include

- How to sample
- Where to sample
- Whom to Sample
- Number of samples
- When to Sample

- Frequency of sampling
- Random changes:
  - Samples can be selected at random per day/shift/season/ hour production
- Duration of sampling

✓ **Monitoring** is a continuous program of observation, measurement, and judgment of an exposure to environmental stress, which has been identified.

- Monitoring is more than simply sampling the environmental stress to which an employee is exposed, or an examination of the medical status of an employee

Cont…

4. Analysis of samples:

- Transport sample in an approved laboratory and analyze according to an approved method
- Interpret results considering worker’s personal habits, health status, exposure time and frequency
- Compare 8-hour exposures with 8-hour standards

5. Interpretation of Results

Occupational diseases

1. Disease of the respiratory system
   - Occupational asthma
   - Hypersensitivity pneumonites e.g. Bagassosis: which is due to exposure to sugar cane residue that contain fungi
   - Byssinosis: due to cotton dust exposure that contain gram –ve bacteria/ fungi

Cont...

- Pneumoconiosis
  - Silicosis: due to free silica (SiO_2)
  - Asbestosis: due to silicates
  - Coal workers' pneumoconiosis/anthracosilcosis/black lung: due to coal dust exposure

Cont...

- Bronchitis
- Emphysema: is the enlargement of air spaces distal to terminal bronchioles, which includes destruction of the alveolar walls and results in air trapping

2. Musculoskeletal disease
   - Tendonitis
   - Neck tension syndrome

Cont...

- Back pain

3. Skin disease
   - Dermatitis
   - Frost bite
   - Hypothermia
   - Skin cancer
4. Eye diseases: Cataract, Conjunctivitis
5. Disease of the Nervous system
   - Neuralgic disorders
     - Central Nervous system e.g. epileptic

Cont...

- Peripheral Nervous system e.g. Neuropathy
  - Behavioral disorders
  - Occupational stress

6. Reproductive disorders
   - Male: Spermatotoxicity, Hormonal alteration
   - Female: Abortion, Stillbirth, Developmental deficits
7. Cardiovascular disease
   - Coronary heart disease e.g. Caused by arsenic, physical inactivity
8. Hematological disorders
   - Hemolysis e.g. caused by arsine gas (AsH3)

Cont...

- Leukemia e.g. caused by benzene
- Suffocation e.g. caused by Co and methemoglobin interference-producing compounds.

9. Liver diseases (hepatic disorders)

- Liver cirrhosis e.g. caused by alcohol: wine and whiskey producer are highly affected
- Acute viral hepatitis e.g. Health care workers due to type B hepatitis
- Liver cancer e.g. due to CCL_4

Cont...

10. Renal and urinary tract Disorders
    - Renal cancer e.g. caused by lead
    - Urinary bladder cancer
    - Urinary tract cancer
    - Acute nephropathy Causes: e.g.
        - Stibine (Antimony hydride: SbH_3)
        - Phosphine (phosphorus hydride; PH_3)
        - Arsine (Arsenic hydride; SbH_3)

Methods of control

- The objection of occupational health hazard control is to ensure that employees' exposure to harmful chemical stresses and physical agents does not result in occupational illness.
- The types of industrial hygiene control measures to be instituted depend on:
  - the nature of the harmful substance or
  - agent and its routes of entry in to the body

Cont...

- To implement control measures requires an understanding of the toxicology of a broad rage of potential hazards including:
  - biological agents,
  - chemical,
  - construction materials, and
  - physical stressors, as well as an understanding of process technologies and work practices.

Cont...

- The methods of control of health hazards in the work environment are divided in to the following categories.

A. Engineering controls

- are to be used as the first line of defense against work place hazards when ever feasible.
- It include :
  - ventilation to minimize dispersion of air borne contaminants,

Cont...

- isolation of a hazardous operation or substance by means of barriers, and
- substitution of material, equipment, or process to provide control of hazard.

- The best time to introduce engineering controls is when the facility is in the design phase i.e. occupational health hazards can best be minimized by work place design.

Cont...

i. Substitution

Changing the material:

- Substitution of non-toxic or less toxic materials for highly toxic ones is often effective method of control

  E.g. replacement of white lead in paint pigments by zinc, barium, or titanium oxides

Cont...

- A change in the physical condition of raw materials received by a facility for further processing

ii. Change the process:

- A process can be modified to reduce the dispersion of dust or fume and thus markedly reduce the hazard

  E.g. Brush-painting or dipping instead of spray painting can minimize the concentration of air borne contaminants.

  Tin solder instead of lead solder in automotive industry

Cont...

a. Isolation

- Potentially hazardous operations should be isolated to minimize exposure to employees
- Isolation is particularly useful for jobs requiring relatively few workers and when control by other methods is difficult or not feasible.
- The hazardous job can be isolated from the rest of the work operation, i.e. reduce the number of workers exposed.

Cont...

- Enclosing the process or equipment is a desirable method of control
- Isolation can also be provided by appropriate use of distance and time, for example, with respect to radiation and noise exposure.
- Isolating hazardous materials in place by sealing these materials in airtight enclosures minimize employers' exposure.

Cont...

b. Ventilation

- It is a method of controlling the work environment by strategically supplying or removing air.
- It is used to dilute the concentration of contaminants to acceptable levels,
- can also serve to control humidity, odor and other environmental conditions for worker comfort

Cont...

B. Administrative controls

- That control employees' exposure by scheduling reduced work times in contaminant areas
- Administrative control of occupational hazards, such as :
  - Work period reduction
  - Job rotation
  - Appropriate work practices
  - Proper maintenance

Cont...

- Limiting number of persons exposed.
- Limiting the time of exposure. etc

N.B. Administrative controls **do not eliminate exposure**

C. Personal protective equipment

- This includes the protection of uncovered parts of the body where the entrance of contaminants is likely to occur.

Cont...

- However, its misuse by management and employees has caused this alternative to be viewed with suspicion.
- Available personal protective devices include:
  - Respiratory protective equipment:
  - air purifying respirators (particulate-filter respirators and gas masks);
  - air –supplied respirators (hose masks and airline respirators); and
-

Cont...

- self-contained respirators (self breathing apparatus).
- Eye and face protection, including goggles and face shields.
- Protective clothing, including gloves, aprons, boots, coveralls.
- Protective creams and lotions, to help minimize skin contract with irritant chemicals.

Cont...

  - Ear protection, including ear plugs and muffs.

- N.B. PPE is the least effective method of controlling occupational hazards and should be used only when other methods cannot control hazards sufficiently