

Introduction to Environmental And Occupational Health Part I

KSU Dept of Family & Community Medicine

435 Lecture Notes by Qusay Ajlan

Original Content | **Titles** | Additional Notes | **Important**

Lecture contents

- Environment:
- Pollution:
- Environmental health
- Concepts of Environment and health
 - EXAMPLE I: Air quality
 - EXAMPLE II: WATER Pollution
 - EXAMPLE III: Water Disinfection
- Epidemiologic Triangle
- Exercises:
 - Pandemic (H1N1) 2009
 - Giardia lamblia
 - Escherichia coli
- Risk Assessment

definitions

- **Health:** is "a state of complete physical, mental and social well-being (for example being unmarried) and not merely the absence of disease or infirmity"
- **Public health:** is "the science and art of preventing disease (like vaccines), prolonging life (we measure the total life span in a certain community, in developed countries the average lifespan is high) and promoting health (social and mental DONE by ministry of health or WHO) through the organized efforts and informed choices of society, organizations, public and private, communities and individuals. "
- **Environment :**In general, environment refers to the surroundings of an object



- **Ecology:** The science of the relationships between organisms and their environments
Also called **BIONOMICS**. Will be asked about it (bionomics refer to ?)

Ecology Cont.

What's the benefit of ecology ? The ultimate goal of ecology is to understand the nature of environmental influences on individual organisms, their populations and communities, on landscapes and, ultimately, the biosphere (all life on Earth). If ecologists can achieve an understanding of these relationships, they will be able to contribute to the development of systems by which humans will be able to wisely use ecological resources, such as **forests, agricultural soils, and hunted animals such as deer and fish.**

Environmental health

Environmental health: is the branch of public health that is concerned with all aspects of the natural and built environment that may affect human health.

Those aspects of the human health and disease that are determined by factors in the environment. EX Cholera bilharzia malaria TB ALSO noise.

It also refers to the theory and practice of assessing and controlling factors in the environment that can potentially affect health.



Pollution

Pollution: is the introduction of pollutants or contaminants into a natural environment that causes instability, disorder, harm or discomfort to the ecosystem i.e. physical systems or living organisms. Pollution can take the form of **chemical** substances or **energy**, such as noise, heat, or light. Pollutants, the elements of pollution, can be foreign substances or energies, or naturally occurring;

When **naturally occurring**, they are considered Pollutants when they exceed natural levels. It means that some substance are present in the environment naturally so if we throw salt in a lake in small amounts its not considered as pollution unless it exceeds the normal levels



Contamination is when we add a material that doesnt exist in that place

Concepts of Environment and health

examples:

- air quality
- Water Pollution
- Water Disinfection

air quality, including both ambient outdoor air and indoor air quality, which also comprises concerns about environmental tobacco smoke.

In the next few slides we will be talking about air in environment and factors that would affect its quality .



Climate Change And Public Health

What causes climate change?

- **Climate forcing**: are events that cause changes in the atmosphere and are a **significant** cause of global climate change whether natural or manmade (anthropogenic).
- **Greenhouse gases*** trap heat in the atmosphere and warm the Earth.

While some greenhouse gases occur naturally, **human activities are amplifying** the natural greenhouse effect and impacting the concentrations of gases in the atmosphere, thereby contributing to climate change.

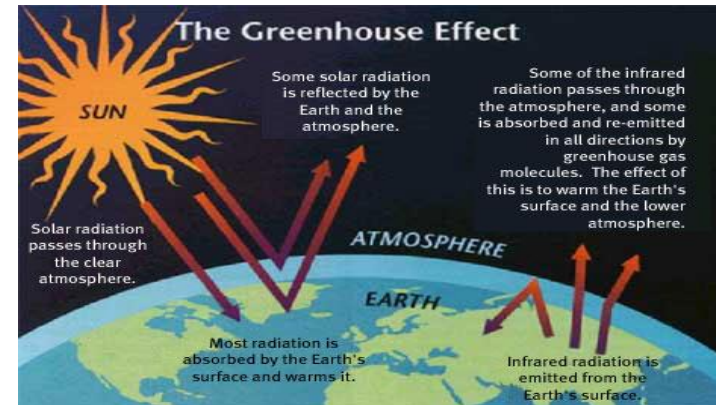
Know these (its not the same) :Global warming and greenhouse effect and ozone hole.

Chlorofluorocarbons (CFCs) are the main cause of ozone hole

The decrease in white space on earth (cold area's) will lead to increase the absorption of heat

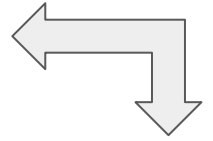
extra

*greenhouse gases are a group of compounds that are able to trap heat (longwave radiation) in the atmosphere, keeping the Earth's surface warmer than it would be if they were not present ,Increases in the amount of greenhouse gases in the atmosphere enhances the greenhouse effect which is creating global warming and consequently climate change.



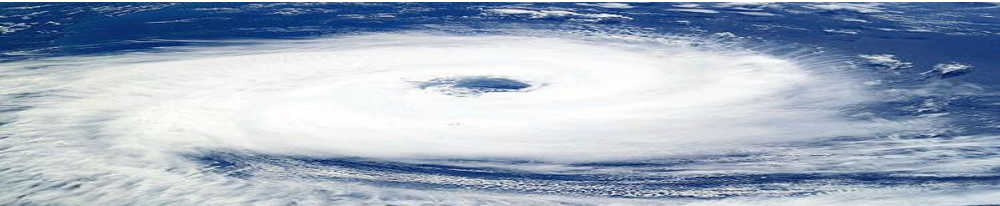
Global Emissions by Gas

Examples of greenhouse gases

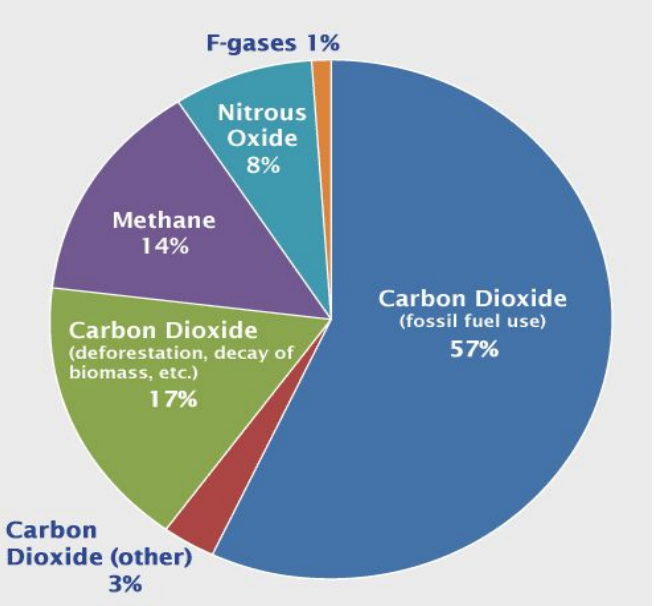


- **Carbon dioxide** (CO₂) - Fossil fuel use is the primary source of CO₂.
- **Methane** (CH₄) - Agricultural activities, waste management, and energy use all contribute to CH₄ emissions.
- **Nitrous oxide** (N₂O) - Agricultural activities, such as fertilizer use, are the primary source of N₂O emissions.
- **Fluorinated gases** (F-gases) - Industrial processes, refrigeration, and the use of a variety of consumer products
- **Black carbon** (BC) is a solid particle or aerosol, not a gas, but it also contributes to warming of the atmosphere.

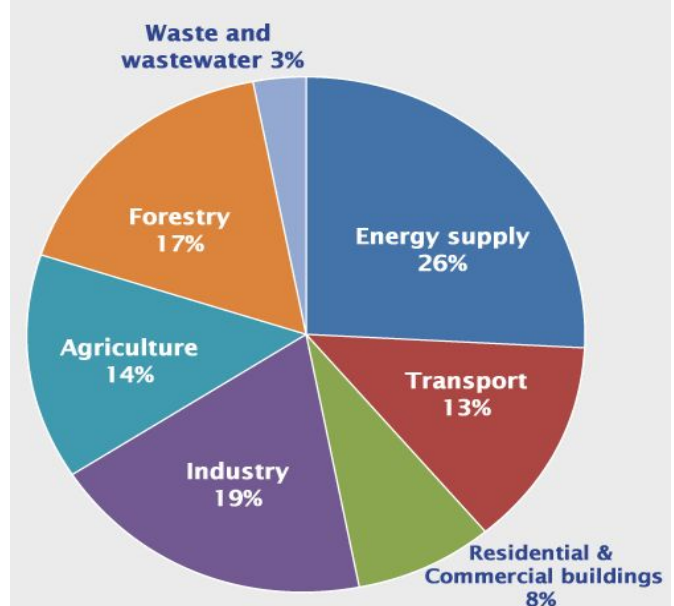
Climate change and its effects on health.

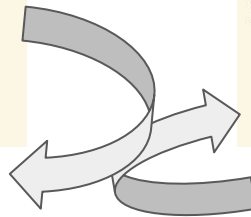
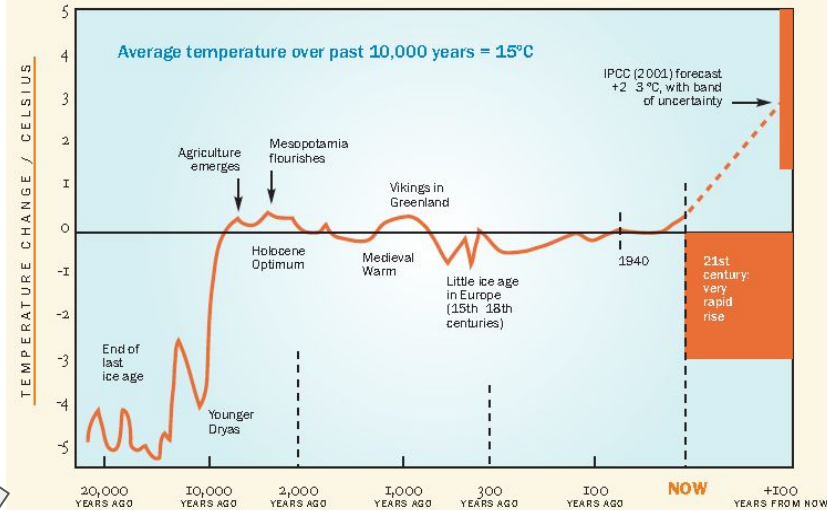
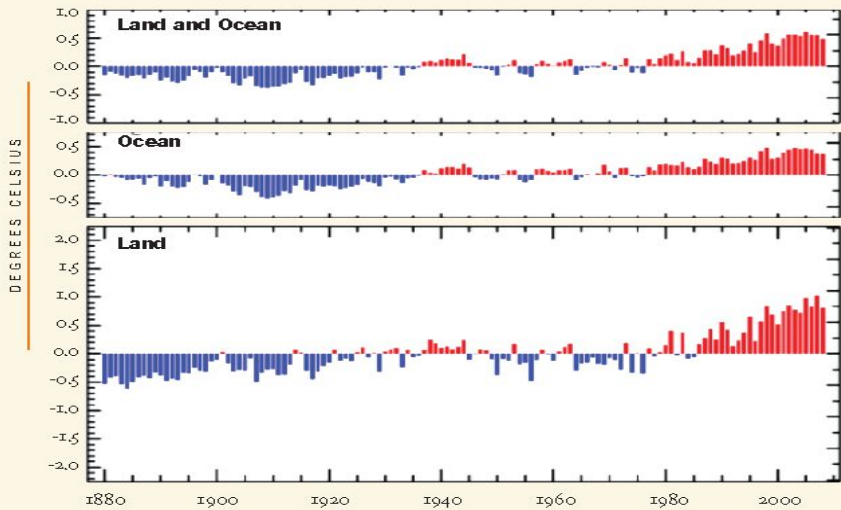


Global Emissions by Gas



Global Emissions by Source

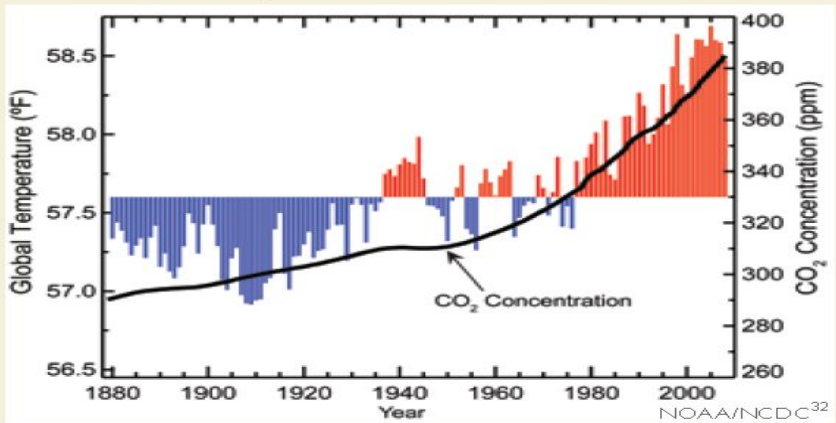




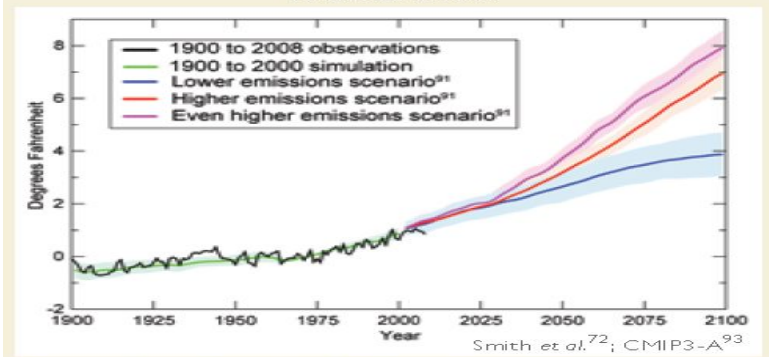
Projecting the Future of Climate Change

- Variations in Earth's Average Surface Temperature Over the Past

Global Temperature and Carbon Dioxide



Global Average Temperature 1900 to 2100





Ground-level Ozone Formation (High concentrations of ozone near ground level can be harmful to people, animals, crops, and other materials. Ozone can irritate your respiratory system)



Global Increase in Heavy Precipitation 1900 to 2100

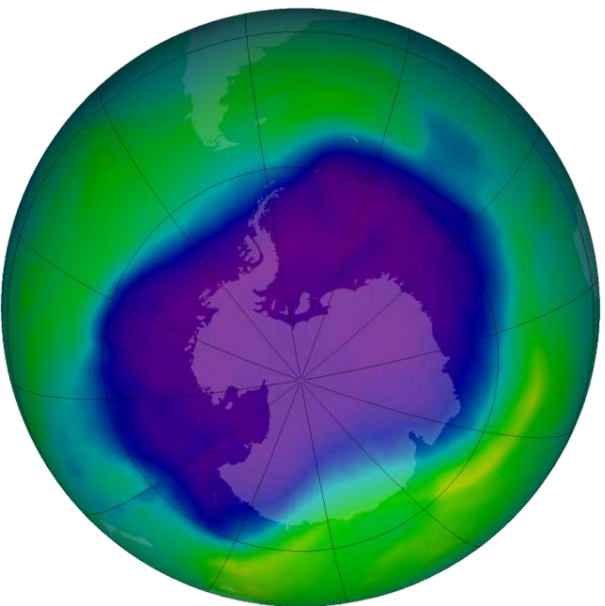
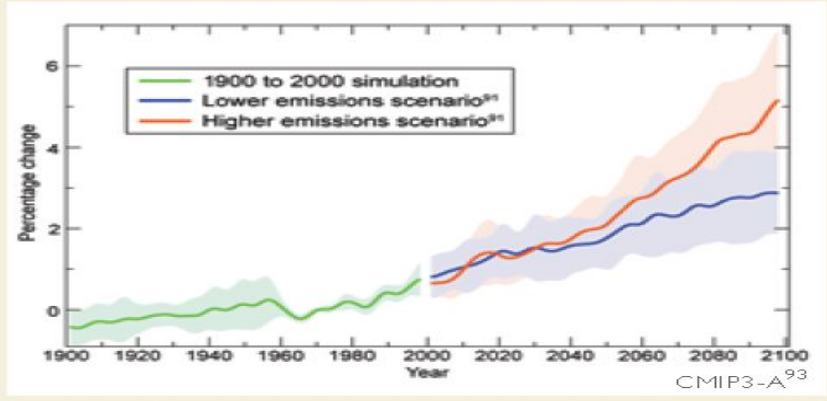
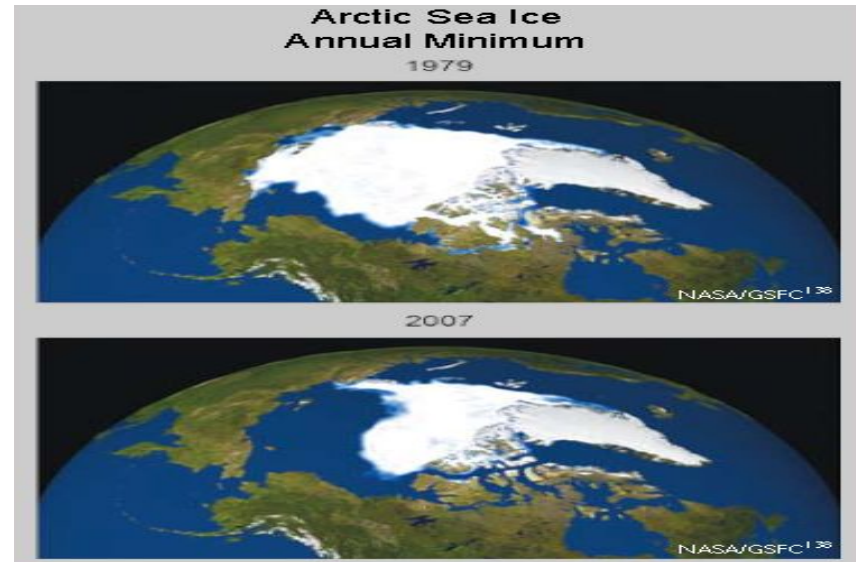
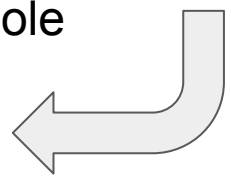
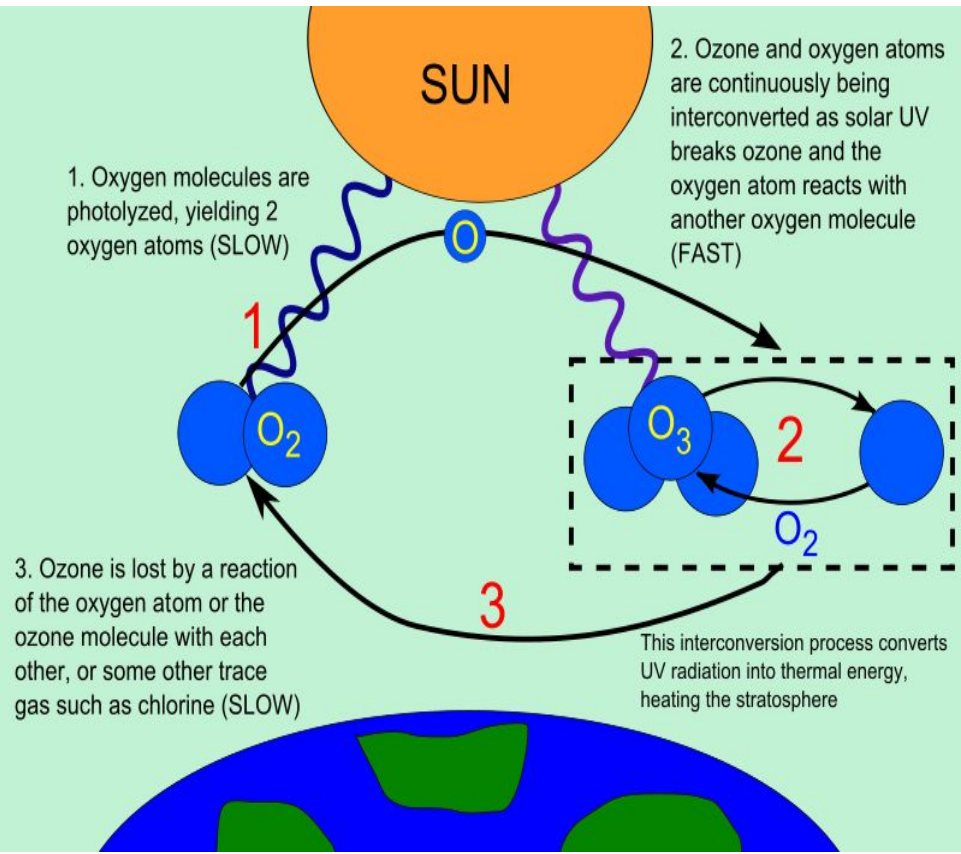


Image of the largest Antarctic ozone hole ever recorded (September 2006), over the Southern pole

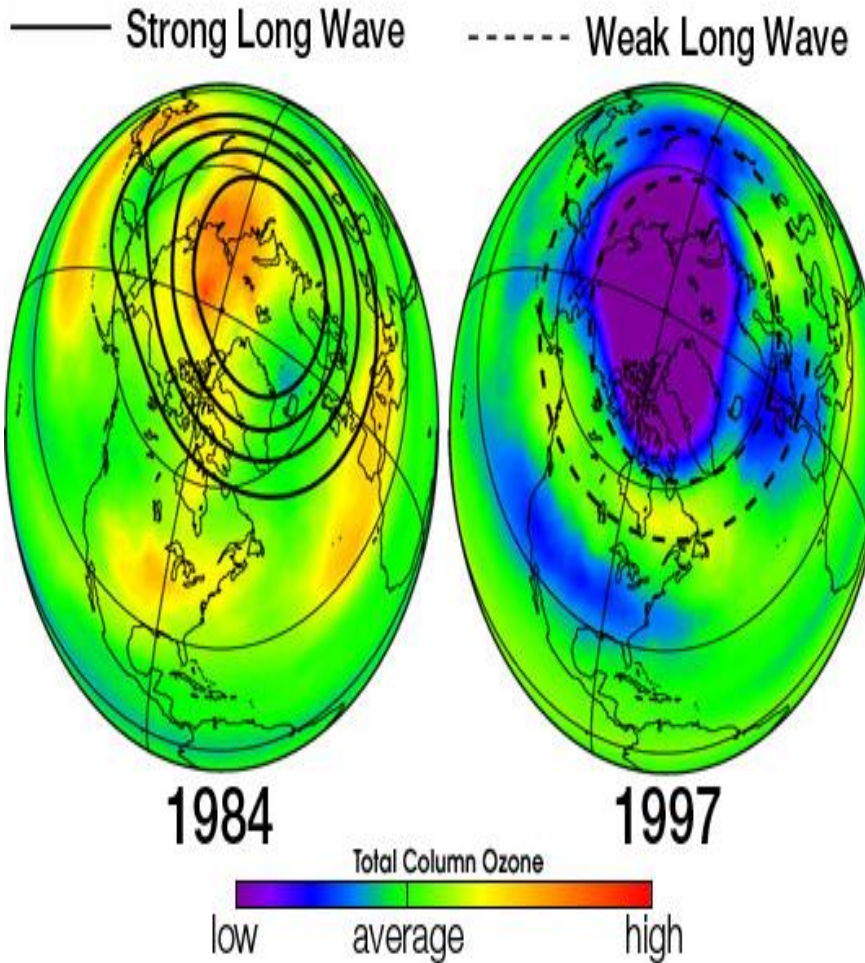


Categories of human health consequences of climate change:

- Asthma, Respiratory Allergies, and Airway Diseases
- **Cancer**
- Cardiovascular Disease and Stroke
- Foodborne Diseases and Nutrition
- Heat-Related Morbidity and Mortality
- Human Developmental Effects
- Mental Health and Stress-Related Disorders
- Neurological Diseases and Disorders
- Vectorborne and Zoonotic Diseases
- Waterborne Diseases



How ozone is formed



Other aspects related to environmental health

1-Disasters affect the environmental health and also increase the global warming so we need to be prepared and response fast

2-Food safety, including in agriculture, transportation, food processing, wholesale and retail distribution and sale. Any defect of any of the previously mentioned parts will affect the human health



cont

3-Hazardous* materials management

including hazardous waste management, contaminated site remediation, the prevention of leaks from underground storage tanks and the prevention of hazardous materials releases to the environment and responses to emergency situations resulting from such releases.

*Hazard is any substance that could cause harm to humans.

- Housing, including substandard housing abatement
- Childhood lead poisoning prevention.
- Land use planning, including smart growth.
- Liquid waste disposal, including city wastewater treatment plants and on-site waste water disposal systems, such as septic tank systems and chemical toilets.
- Medical waste management and disposal. Only 25% of medical wastes are infectious and if we mix all together all will become infectious (hazardous)

cont.

- **Noise** pollution control.
- **Occupational health** and **industrial hygiene**.
- **Radiological health**, including exposure to ionizing radiation from X-rays or radioactive isotopes.
- **Recreational water illness prevention**, including from swimming pools, spas and ocean and freshwater bathing places.
- **Solid waste management**, including landfills, recycling facilities, composting and solid waste transfer stations If not managed properly t > flies rats and other vectors > more diseases
- **Safe drinking water**. Water has to be colorless smellless tasteless and doesnt cause any harmful effects to the body
- **Toxic chemical exposure** whether in consumer products, housing, workplaces, air, water or soil.



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Household Hazardous Waste

- **Paints** and solvents
- Automotive wastes (used motor oil, antifreeze, etc.)
- **Pesticides** (insecticides, herbicides, fungicides, etc.)
- Mercury-containing wastes (thermometers, switches, fluorescent lighting, etc.)
- Electronics (computers, televisions, cell phones)
- Aerosols / Propane cylinders
- Cleaning agents
- Refrigerant -containing appliances
- Some specialty Batteries (e.g. lithium, nickel cadmium, or button cell batteries)
- Radioactive waste (some home smoke detectors are classified as radioactive waste because they contain very small amounts of a radioactive isotope of americium).

Doctor didnt read it in detail

EXAMPLE I: Air quality

primary pollutants include

1-Nitrogen oxides (NO_x) - especially nitrogen Carbon monoxide - is a colourless, odorless, non-irritating but very poisonous gas

2-Carbon dioxide (CO₂) - a colourless, odorless, **non-toxic** greenhouse gas associated with ocean acidification, emitted from sources such as combustion, cement production, and respiration

3-Particulate matter - Particulates, alternatively referred to as particulate matter (PM) or fine particles, are tiny particles of solid or liquid suspended in a gas.

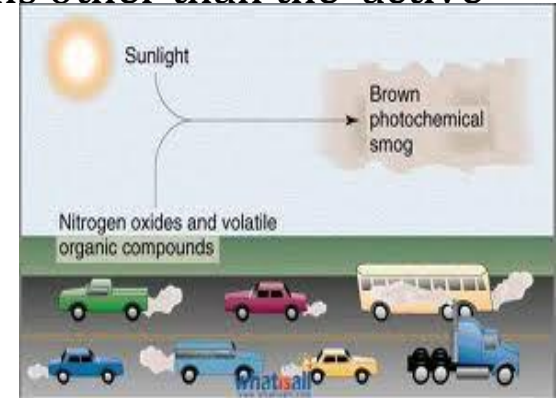
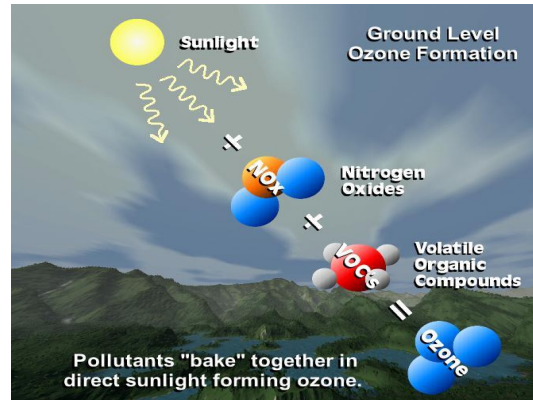
4-Toxic metals, such as lead, cadmium and copper.

5-Chlorofluorocarbons (CFCs) - harmful to the ozone layer emitted from products currently banned from use.

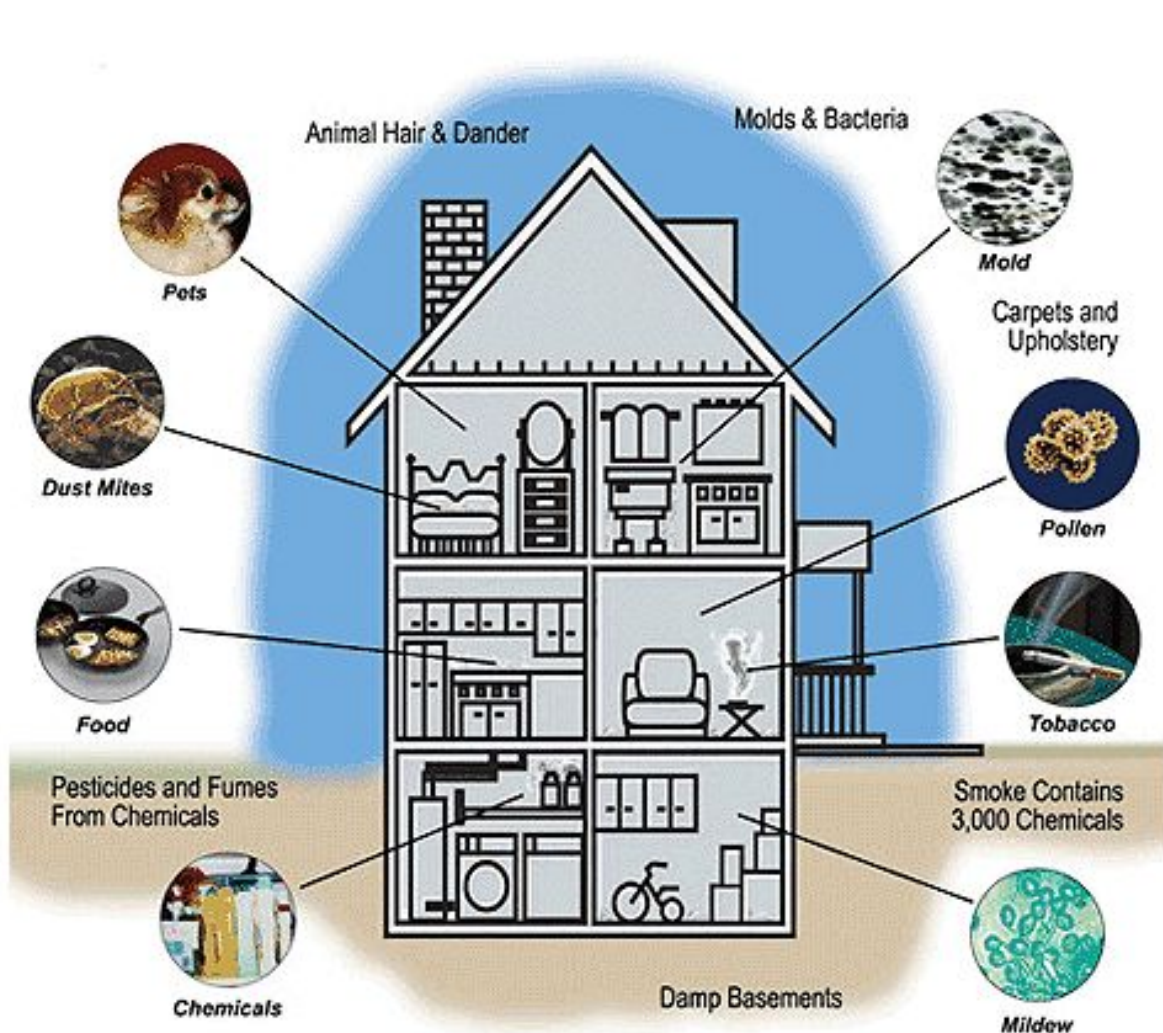
6-Ammonia (NH₃) - emitted from agricultural processes.

Cont

- **Secondary pollutants** :are not emitted directly. Rather, they form in the air when primary pollutants react or interact. include:
- **Particulate matter (particles less than 2.5 micrometer are very dangourous) exam question** formed from gaseous primary pollutants and compounds in **photochemical smog**.
- **Ground level ozone** (O3) formed from NOx and VOCs. Ozone (O3) is a key constituent of the troposphere. (very harmful)
- **Second-hand smoke** is tobacco smoke which affects persons other than the 'active' smoker.



How particulate matter is formed



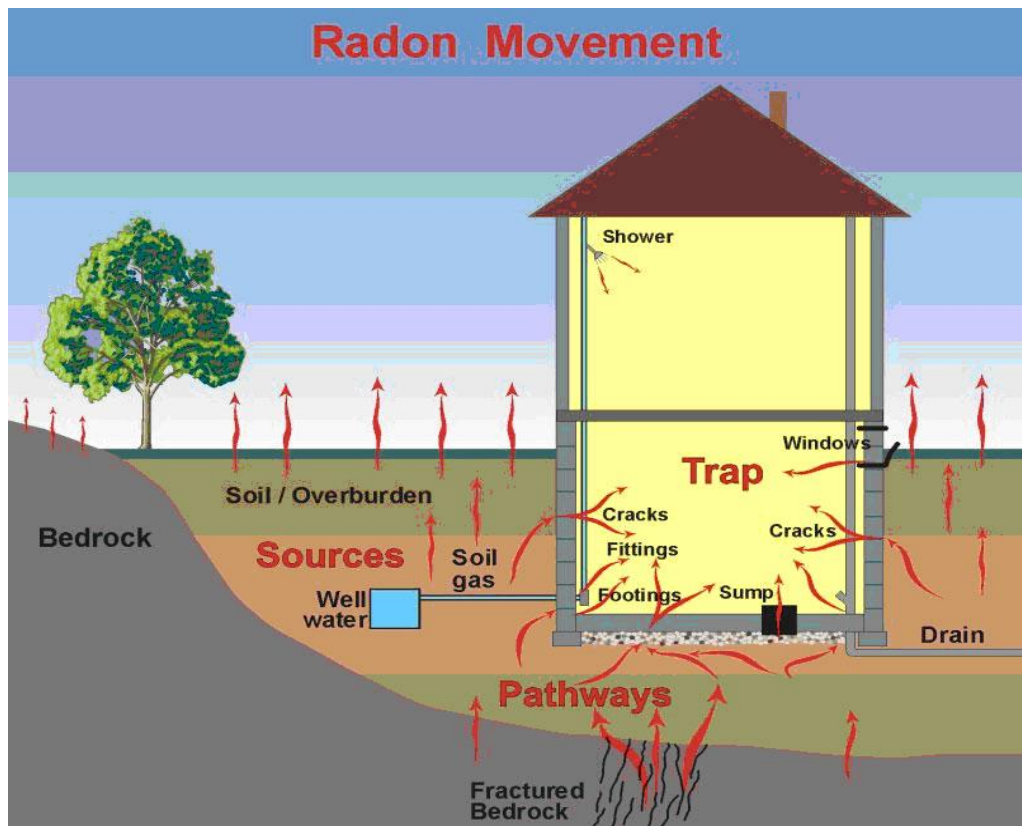
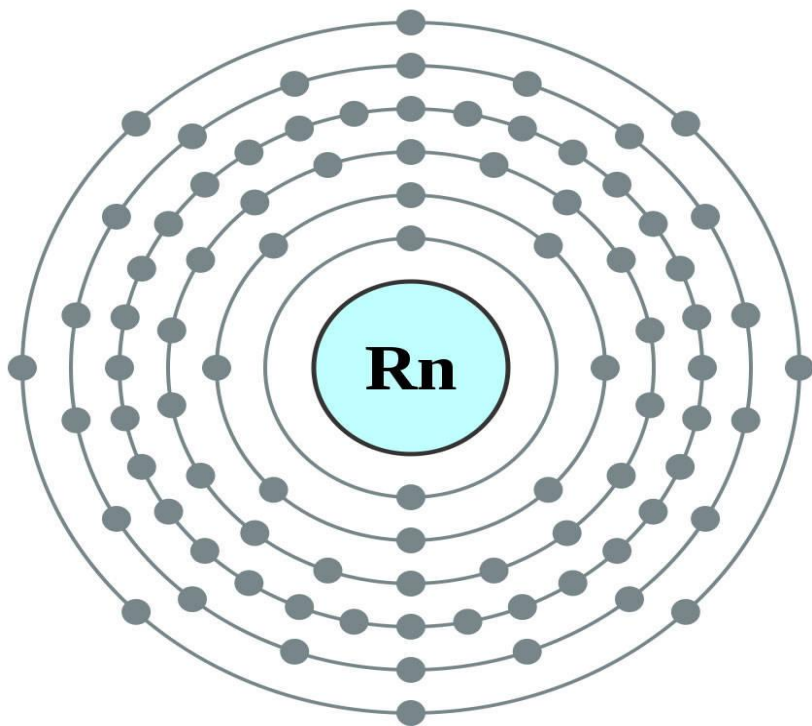
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- **RADON** :Radon is an invisible, **radioactive** atomic **gas** that results from the **radioactive decay** of **radium**, which may be found in rock formations beneath buildings or in certain building materials themselves. Radon is probably the most pervasive serious hazard for indoor air in the United States and Europe, probably responsible for tens of thousands of deaths from lung cancer each year. Found usually in places filled with uranium
- **Moulds And Other Allergens** These biological chemicals can arise from a host of means, but there are two common classes:
 - (a) Moisture induced growth of mold colonies and
 - (b) Natural released into the air such as animal dander and plant pollen.There are some varieties of mould that contain toxic compounds (**mycotoxins**).



86: Radon

2,8,18,32,18,8



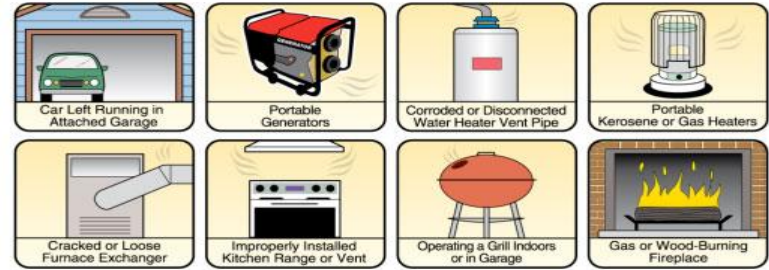
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- **CARBON MONOXIDE** (most common secondary pollutant).

A **colourless, odourless** gas that is a byproduct of incomplete combustion of fossil fuels.

Common sources of carbon monoxide are tobacco smoke, space heaters using fossil fuels, defective central heating furnaces and automobile exhaust.

The problem is that it binds to hemoglobin 300 times stronger



- **VOLATILE ORGANIC COMPOUNDS**

Concentrations of many VOCs are consistently higher indoors (**up to ten times higher**) than outdoors. **Examples** include: paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials and furnishings, office equipment such as copiers and printers, correction fluids and carbonless copy paper, graphics and craft materials including glues and adhesives, permanent markers, and photographic solutions.

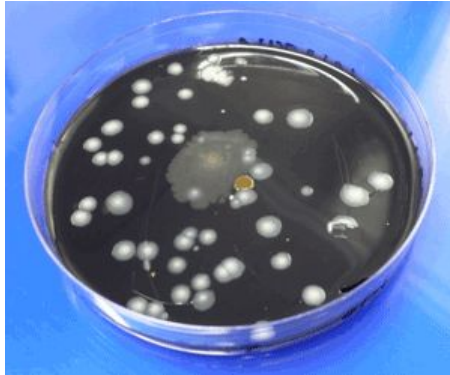
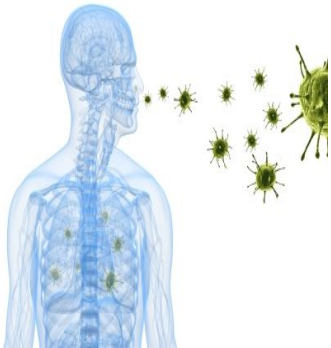
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- **LEGIONELLA** could cause pneumonia

Legionellosis or Legionnaire's Disease is caused by a waterborne bacterium Legionella that grows best in slow-moving or still, warm water.

The primary route of exposure is through the creation of an **aerosol effect**, most commonly from **evaporative cooling towers** or **showerheads**.

Legionella testing typically involves collecting water samples and surface swabs from evaporative cooling basins, shower heads, and other locations where warm water collects



Cont.

- **Asbestos fibers** will be discussed in detail later

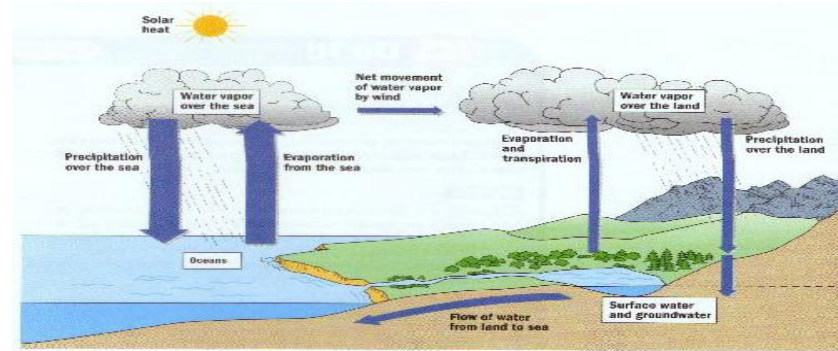
Asbestos is found in older homes and buildings, but it is most dangerous in schools and industrial settings



EXAMPLE II: WATER:

Life cycle of water :

- Evaporation and Transpiration
- Condensation and Precipitation
- Runoff and infiltration
- Streams
- Groundwater – held in aquifers

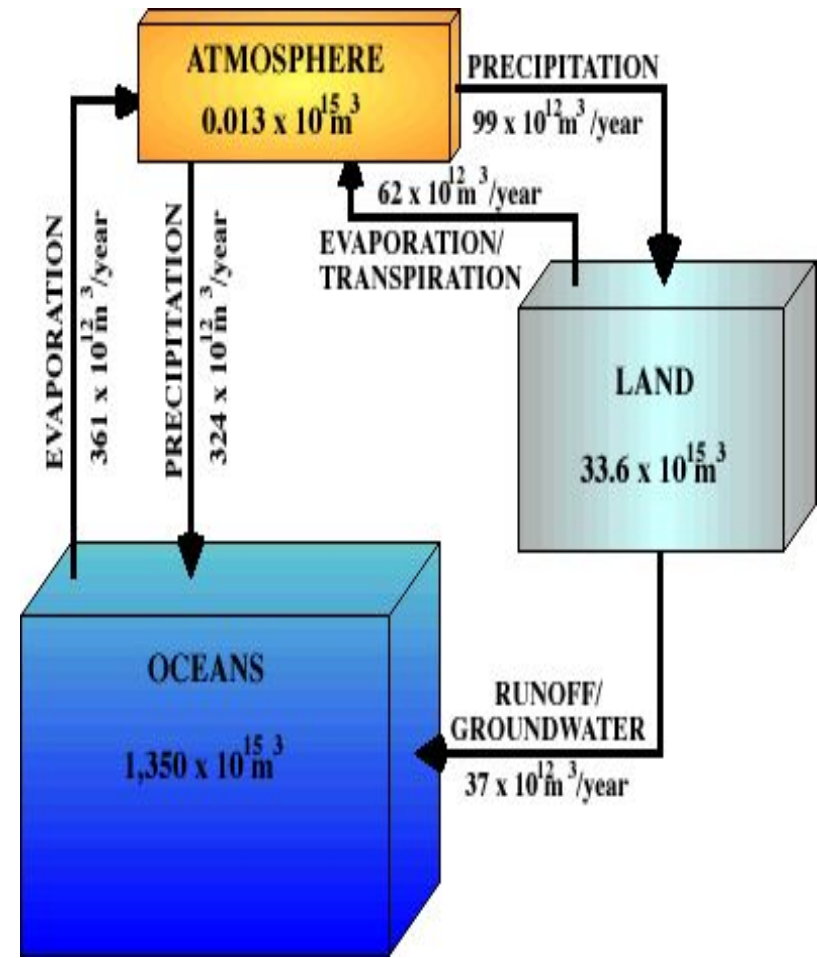
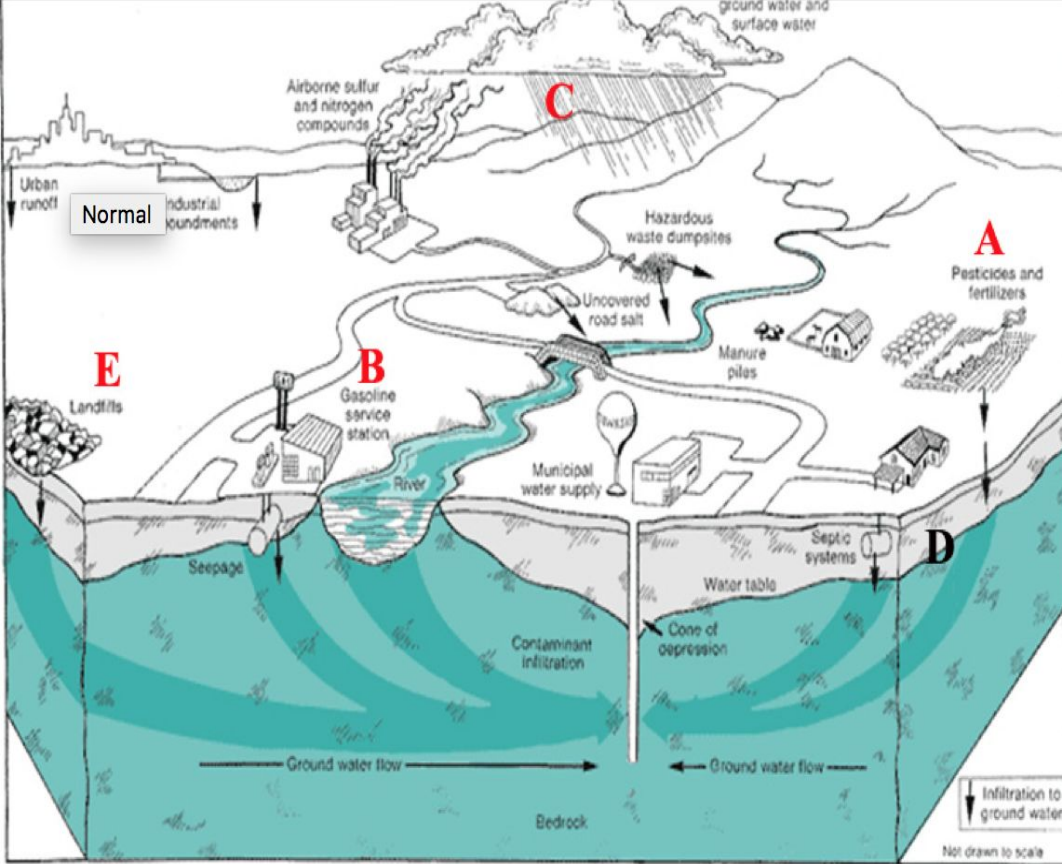


3 types of water : groundwater , rainwater, surfacewater

(ground water is the type that gets affected (polluted) the easiest (will be asked about it)

Sources of Pollution & Causes of Contamination:

- Improper Waste Disposal
- Improper Well Construction
- Poor Site Selection
- Wells Not Properly Abandoned
- Improper Waste Storage
- Lack of Information on Hazardous Sites or Activities



- A/pesticides and fertilizers
- B/Gasoline station
- C/Airborne sulfur and nitrogen (will cause acid rain (kill plants))
- E/Landfill (A landfill site is a site for the disposal of waste materials by burial)

Example III: water disinfection

Water Disinfection:

1. Chlorination. using chlorine
2. Ozonization. using ozone
3. Bromination. using bromine.
4. Iodination. using iodine.
5. Exposure to Ultra Violet Rays using UV Rays.
6. Heating. By boiling
7. Addition of lime. using lime.
8. Exposure to Ultra Sonic Waves.

A



B



Chlorination is the most common method for ease of control and low cost in addition to its effectively.

Applying Chlorination in rural areas:

This could be carried out with any powder or solution containing Cl_2 as:

- A. Chlorinated lime = **Bleaching powder**, 25-35% Cl_2
- B. HTH = **High test hypochlorite powder**, 70-75% Cl_2 .
- C. **Sodium hypochlorite solution**, 15% Cl_2

C



Example

Water quantity = 100 m³/day.

Residual Cl₂ required = 0.5 ppm (mg/L)

Cl₂ demand = 0.6 ppm (mg/L)

(0.5mg/l of pure chlorine IS THE REQUIRED DOSE TO DISINFECT WATER COMPLETELY)

(0.6 represent the amount needed to oxidize organic material differs from material to another)

Cl₂ dose = 0.5 + 0.6 = 1.1 ppm (mg/L)

So every 1 m³ needs 1.1 gm Cl₂-

100 m³ need 100 x 1.1 = 110 gm Cl₂/**day**

for one month 110 x **30** = 3300 gm Cl₂

Every 1 gm of HTH contains 0.75 gm Cl₂

100x1.1x30 = 3300 this result means that we will need 3.3kg of pure chlorine but if we want to use HTH

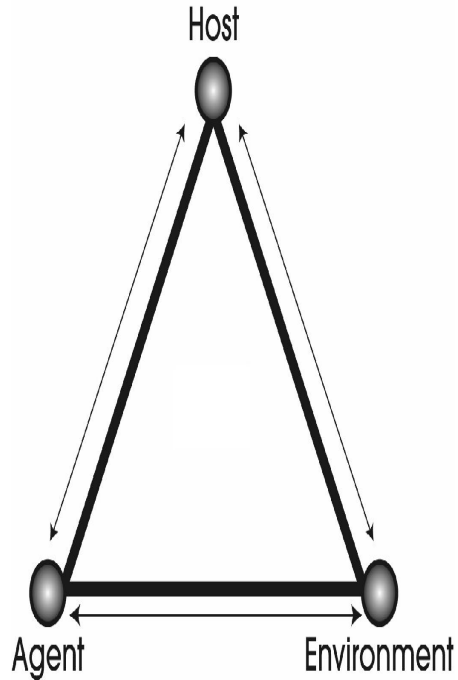
which each 1 gram 75% will be cl₂ so we divide 3300/0.75 = 4400 (HTH contains chlorine in it check the previous slide)

So amount of HTH needed = 3300/0.75 = 4400 gm HTH / month

= 4.4 Kg HTH / month

Epidemiologic Triangle

Composed of :
1-host
2-environment
3-agent



Giardiasis

(*Giardia intestinalis*)

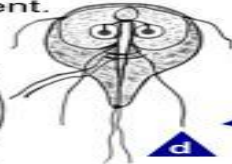


Contamination of water, food, or hands/fomites with infective cysts.

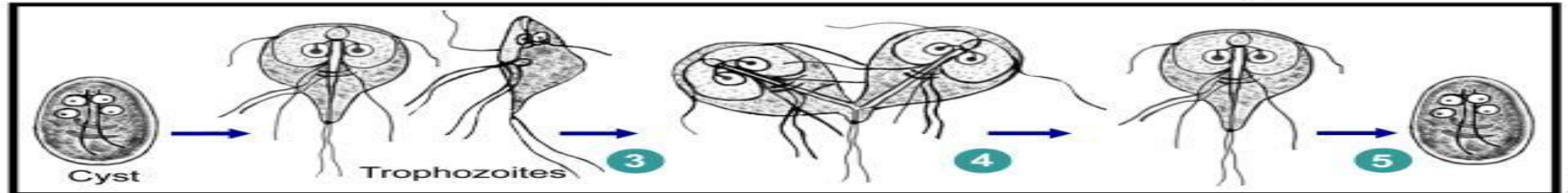
Trophozoites are also passed in stool but they do not survive in the environment.

1

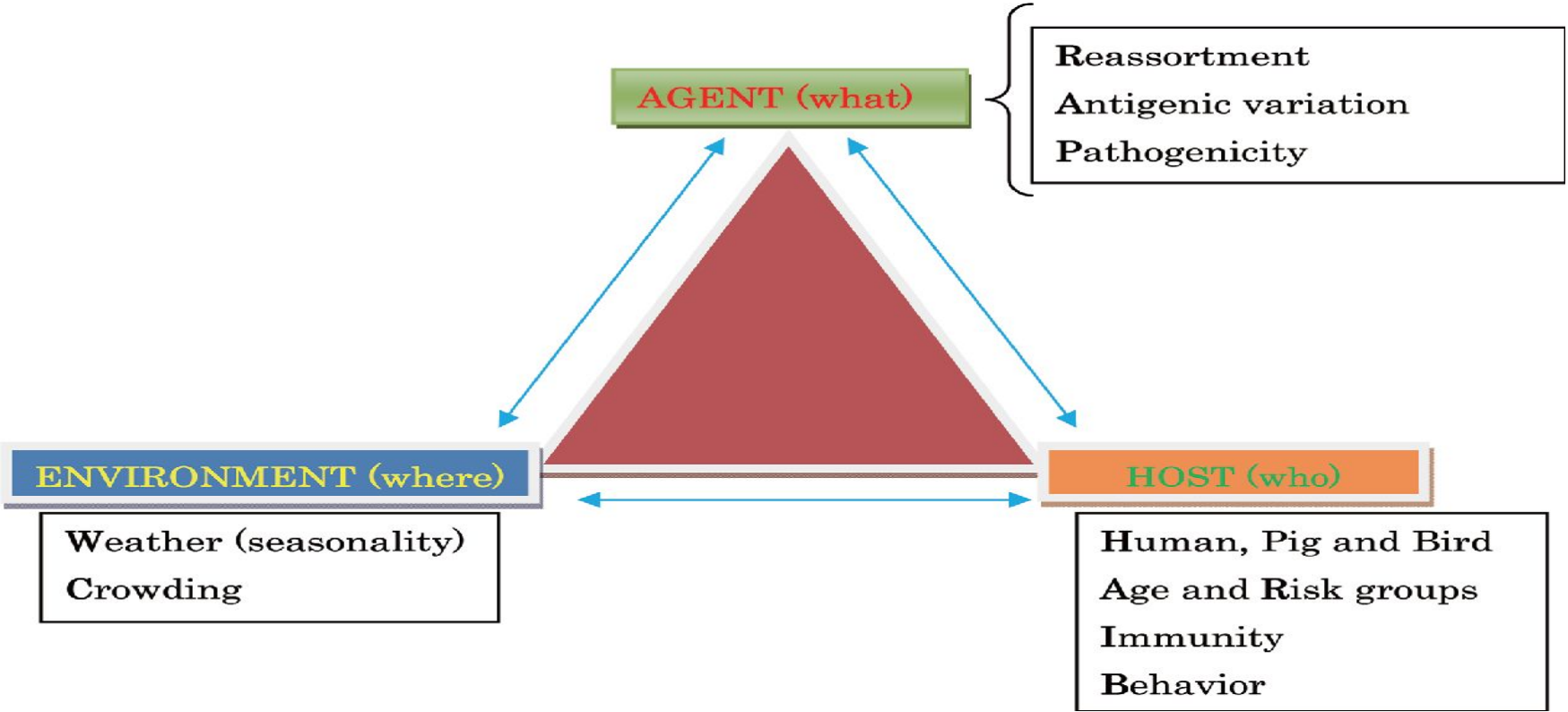
i
d



i = Infective Stage
d = Diagnostic Stage



•Pandemic (H1N1) 2009 Virus Viewed from an Epidemiological Triangle Model



Risk assessment

Potential for risk

HAZARD  EVENT  CONSEQUENCE


















E. Coli 0157  Chlorinator fails  People are Sick (some die)

For each event:

- How severe would the public health consequences be? [**Severity**]
- How likely is the event to happen ? [**Frequency**]

Importance = Severity X Frequency

Risk scoring matrix

Likelihood	Severity of Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain					
Likely					
Possible	-				
Unlikely	-	-			
Rare	-	-	