Community 432 Medicine

Doctor's notes are in **green**.
Additional information are in **orange**.
Unmentioned information are in **grey**.

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جامعة الملك سعود
King Saud University

Introduction to ENVIRONMENTAL AND OCCUPATIONAL HEALTH

YEAR
1435-1436 Hajji
2014 - 2015 Gregorian

session Description	Environmental & Occupational health
Topics covered	1. Concepts of environment and health 2. Environmental hazards 3. Control of environmental hazards 4. Mass gathering and health 5. Principals of occupational health 6. Examples of occupational diseases

	Topic	Time	Date	Day	
A	Environmental Health and hazards	1-2 PM	06/05/1436	25/02/2015	Wednesday
	Prevention and Control of environmental hazards	10-11AM	07/05/1436	26/02/2015	Thursday
	Introduction to occupational health	11-12PM	07/05/1436	26/02/2015	Thursday
	Occupational diseases	10-11AM	10/05/1436	1/3/2015	Sunday
	Epidemiology of Heat stroke & Heat exhaustion	10-11AM	14/05/1436	5/3/2015	Thursday
	Occupational Risks and Diseases	2-3 PM	19/05/1436	10/3/2015	Tuesday

	Topic	Time	Date	Day	
B	Environmental Health and hazards	10-11 AM	28/04/1436	18/02/2015	Wednesday
	Prevention and Control of environmental hazards	3-4 PM	04/05/1436	23/02/2015	Monday
	Introduction to occupational health	1-3 PM	05/05/1436	24/02/2015	Tuesday
	Occupational diseases	3-4 PM	11/05/1436	2/3/2015	Monday
	Epidemiology of Heat stroke & Heat exhaustion	10-11AM	13/05/1436	4/3/2015	Wednesday
	Occupational Risks and Diseases	3-4 PM	18/05/1436	9/3/2015	Monday

	Topic	Time	Date	Day	
F	Environmental Health and hazards	10-11 AM	04/05/1436	23/02/2015	Monday
	Prevention and Control of environmental hazards	10-12 AM	05/05/1436	24/02/2015	Tuesday
	Introduction to occupational health	8-9 AM	06/05/1436	25/02/2015	Wednesday
	Occupational diseases	10-11 AM	11/05/1436	2/3/2015	Monday
	Epidemiology of Heat stroke and Heat exhaustion	12-Nov	12/05/1436	3/3/2015	Tuesday
	Occupational risks and diseases	8-9 AM	20/05/1436	11/3/2015	Wednesday

WHAT IS Health?

State of Health

Health is
"a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"

Public health

is

"the science and art of preventing disease, prolonging life and promoting health

through the organized efforts and informed choices of society, organizations, public and private, communities and individuals. "

part	Environmental Health
1	

1.1. **Environment:**
1.2. Pollution:
1.3. Environmental health
1.4. Concepts of Environment and health

EXAMPLE

EXAMPLE I: Air quality
EXAMPLE II: WATER Pollution
EXAMPLE III: Water Disinfection

1.5. **Epidemiologic Triangle**

Exercises:

1. Pandemic (H1N1) 2009
2. Giardia lamblia
3. Escherichia coli

1.6. **Risk Assessment**

1.1. Environment:

In general, environment refers to the surroundings of an object


Ecology
Environment
Health

Ecology

- The science of the relationships between organisms and their environments.
- Also called BIO NO MICS.

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.**

Environment

In general, environment refers to the surroundings of an **object.**

Health

A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity

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.

1.3. 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.

Environmental health:

Those aspects of the human health and disease that are determined by factors in the environment.

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

1.4. Concepts of Environment and health

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

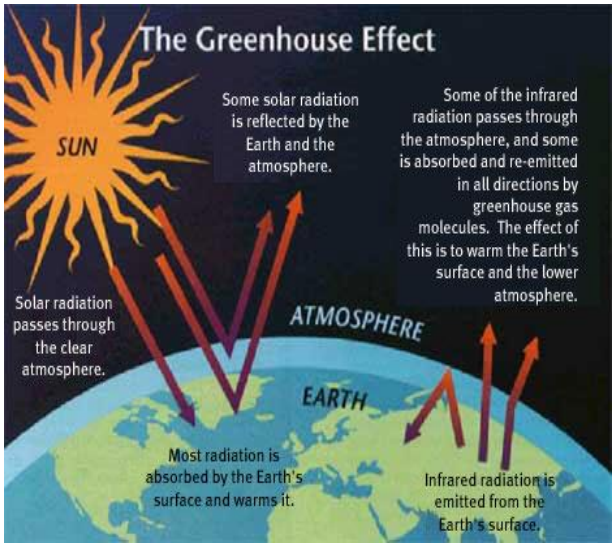
Climate Change And Public Health

What Causes Climate Change?

"Climate forcing"
whether natural or manmade
(anthropogenic) are events that cause
changes in the atmosphere and are a
significant cause of global climate change.

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.

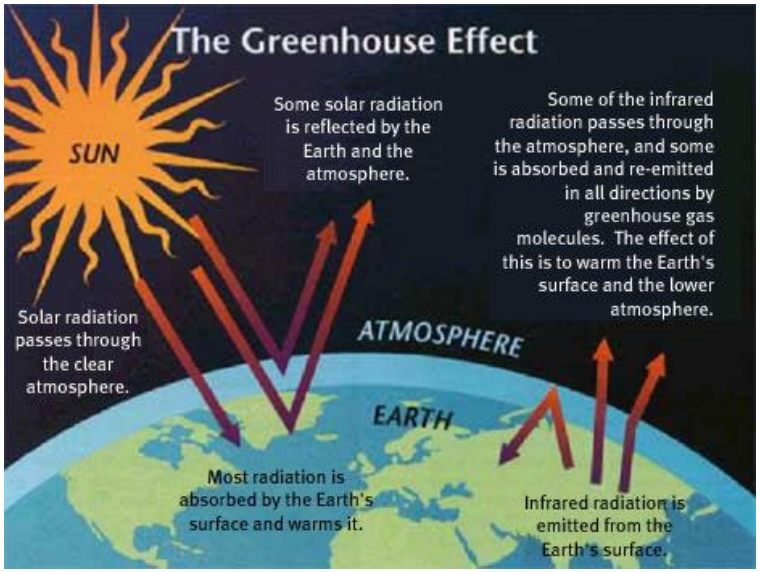


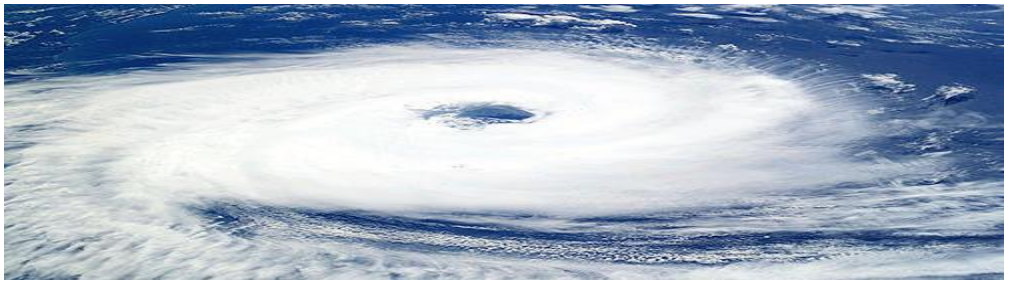
The **greenhouse effect** is a process by which thermal radiation from a planetary surface is absorbed by atmospheric greenhouse gases, and is re-radiated in all directions

Global Emissions by Gas

- ✓ 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.(its effects are 14 times more than carbon dioxide which means 1 CH4 = 14 CO2)
- ✓ 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.

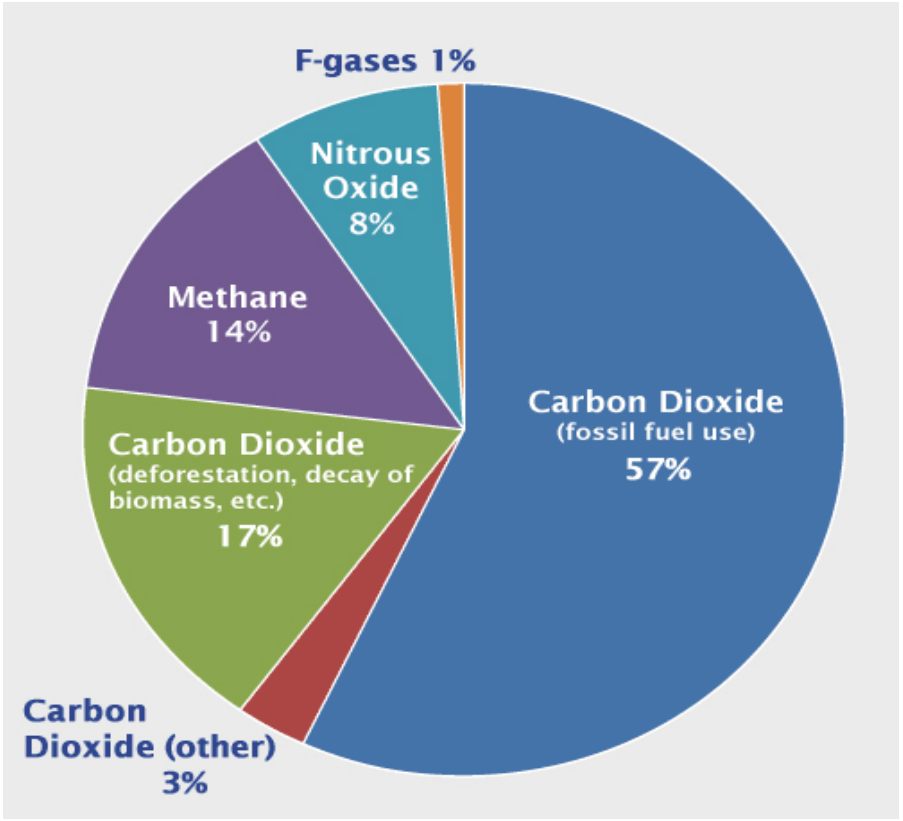
- **Climate change** and its effects on health.





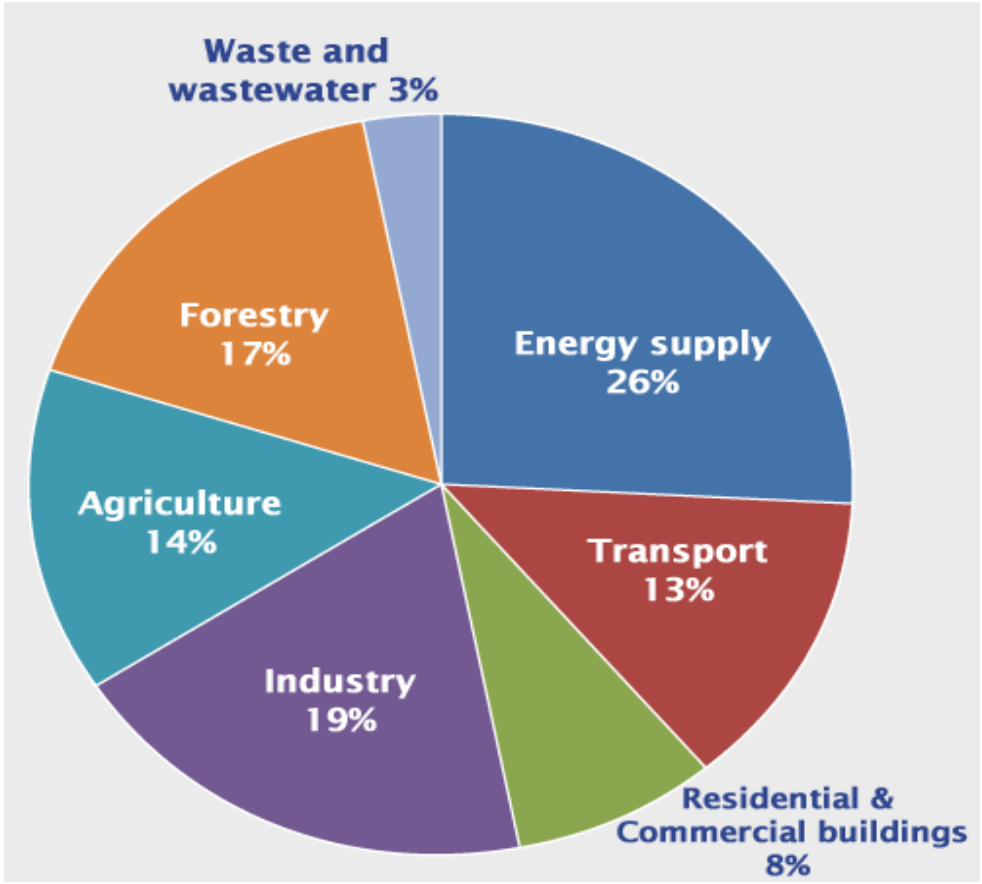
Any decomposition of organic compound will produce **methane**

Global Emissions by Gas

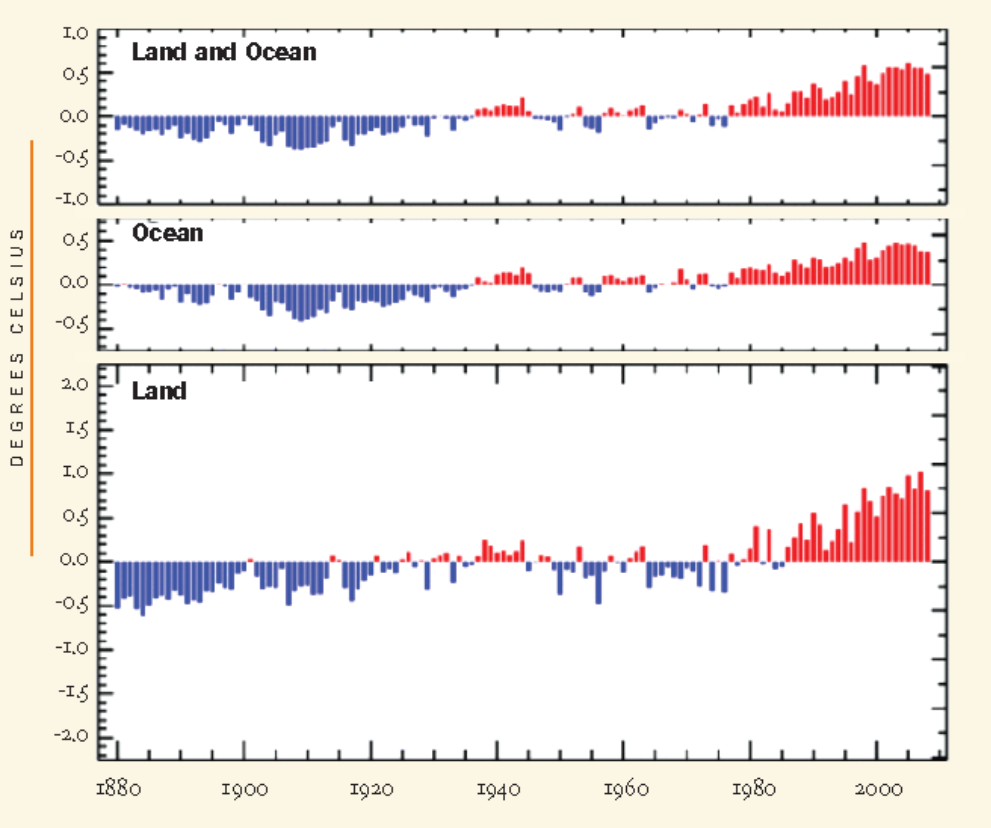


Percentages are NOT important but you have to know which one is the more common :P

Global Emissions by Source



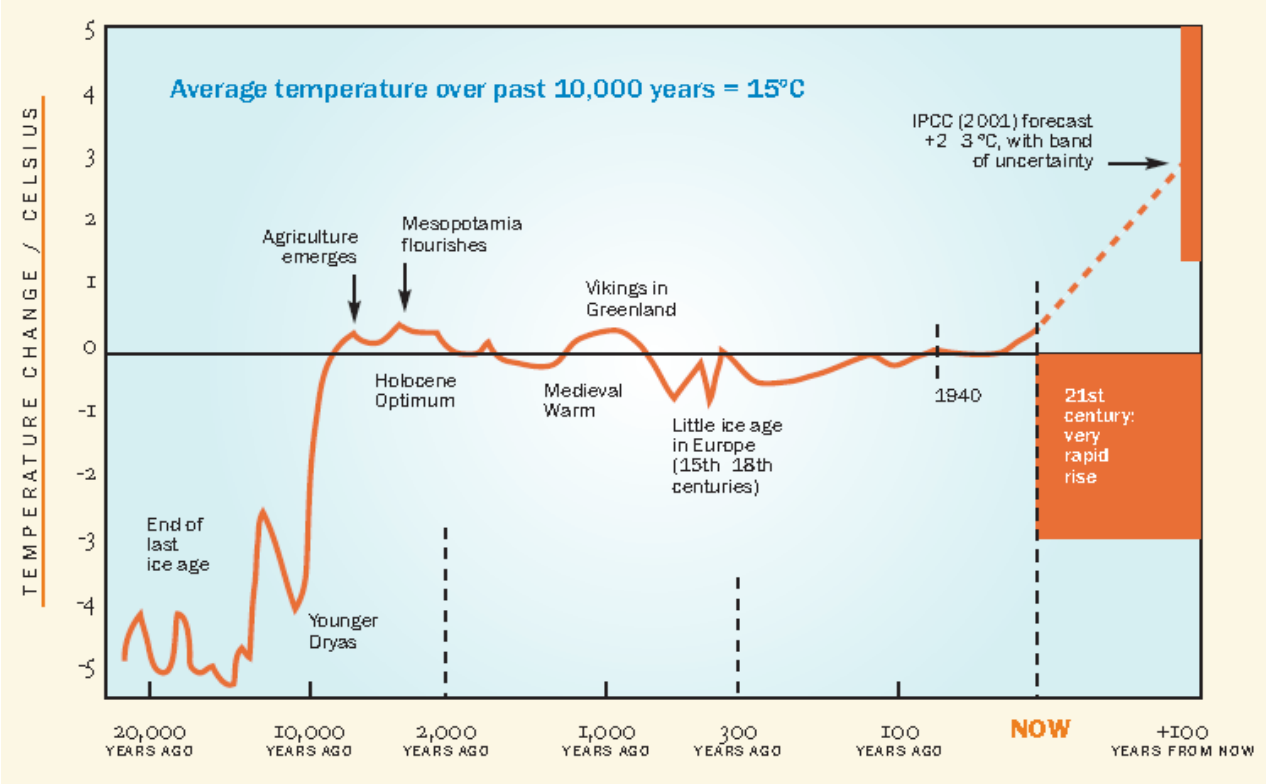
Projecting the Future of Climate Change



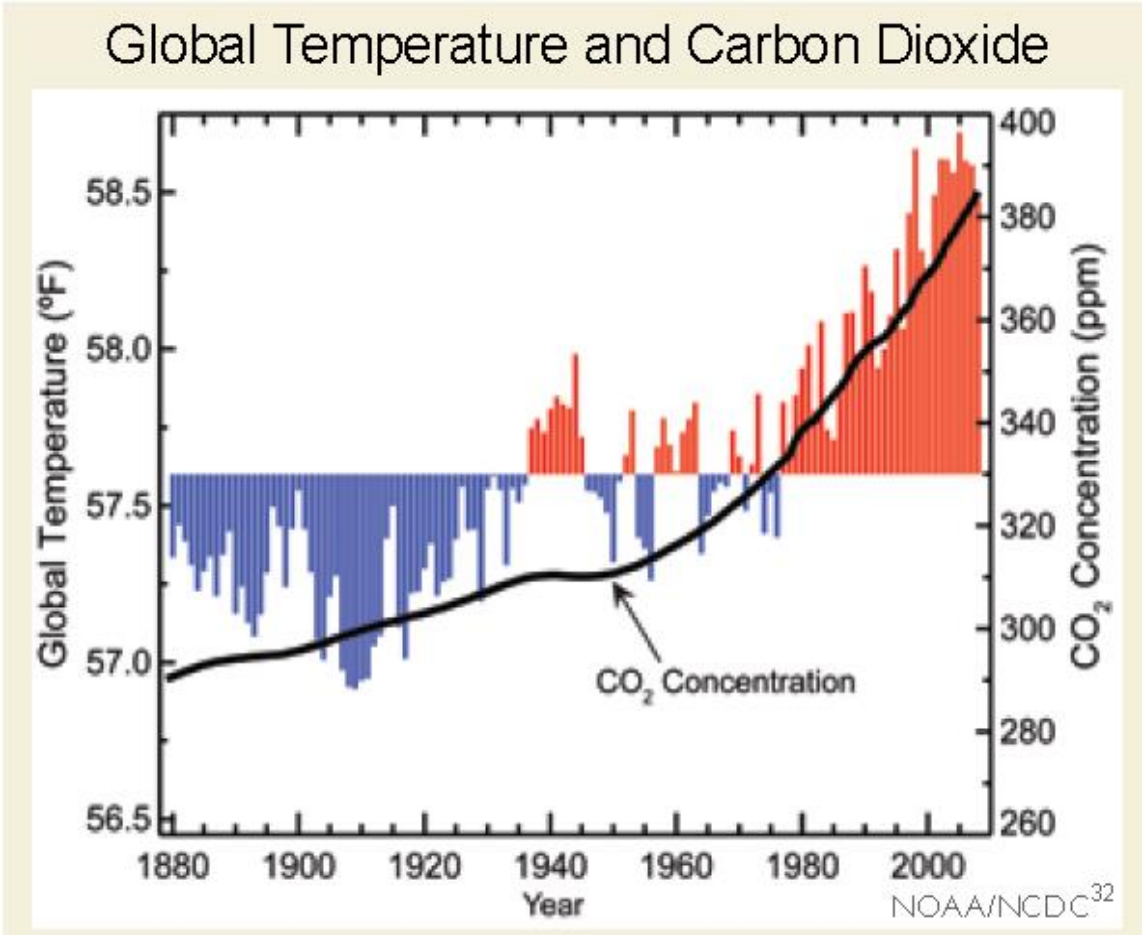
There is an obvious relation between the heat and time so the heat increase in relation to the time

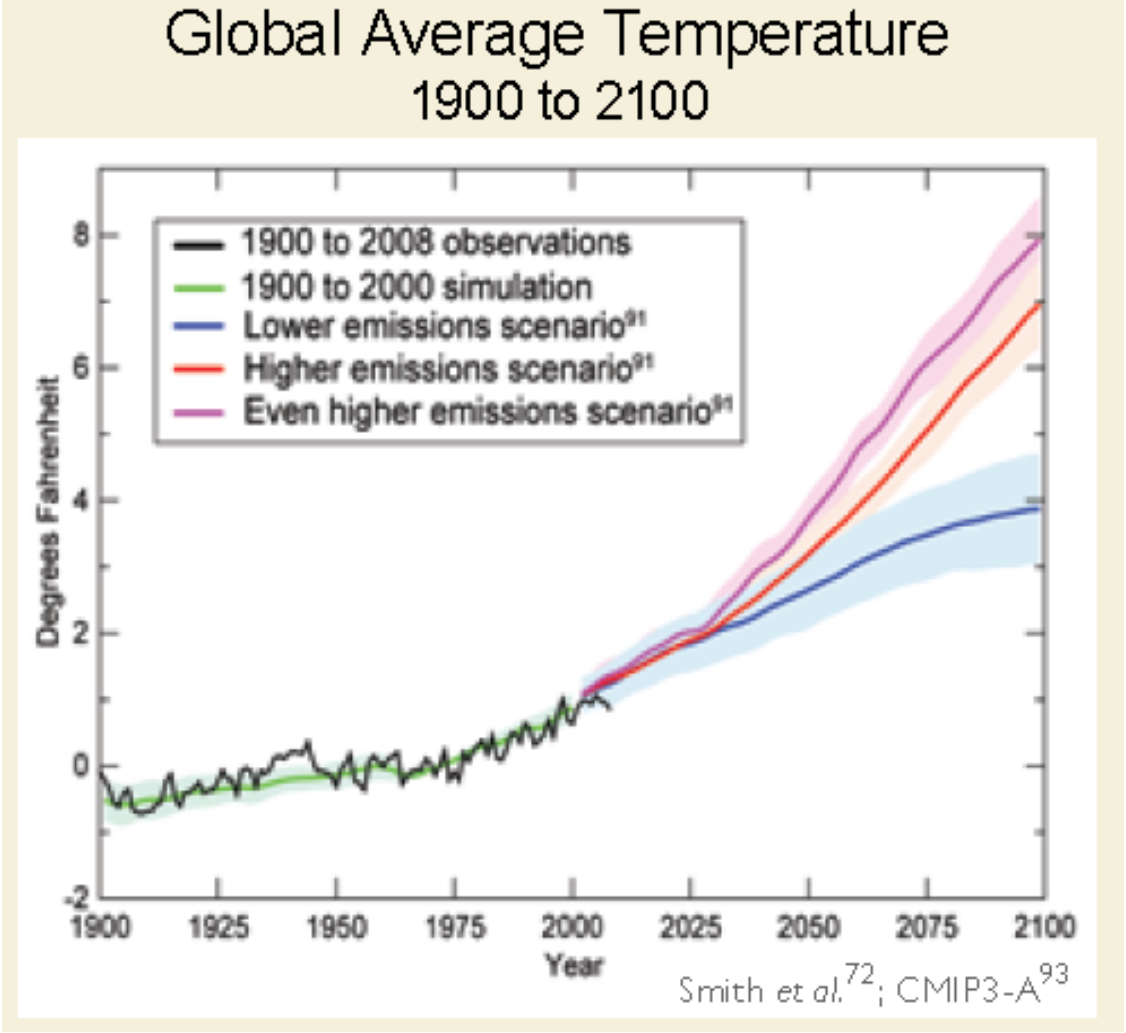
Its started in 1880 because at that time the heat record was just discovered

January–December Global Surface Mean Temperature Anomalies

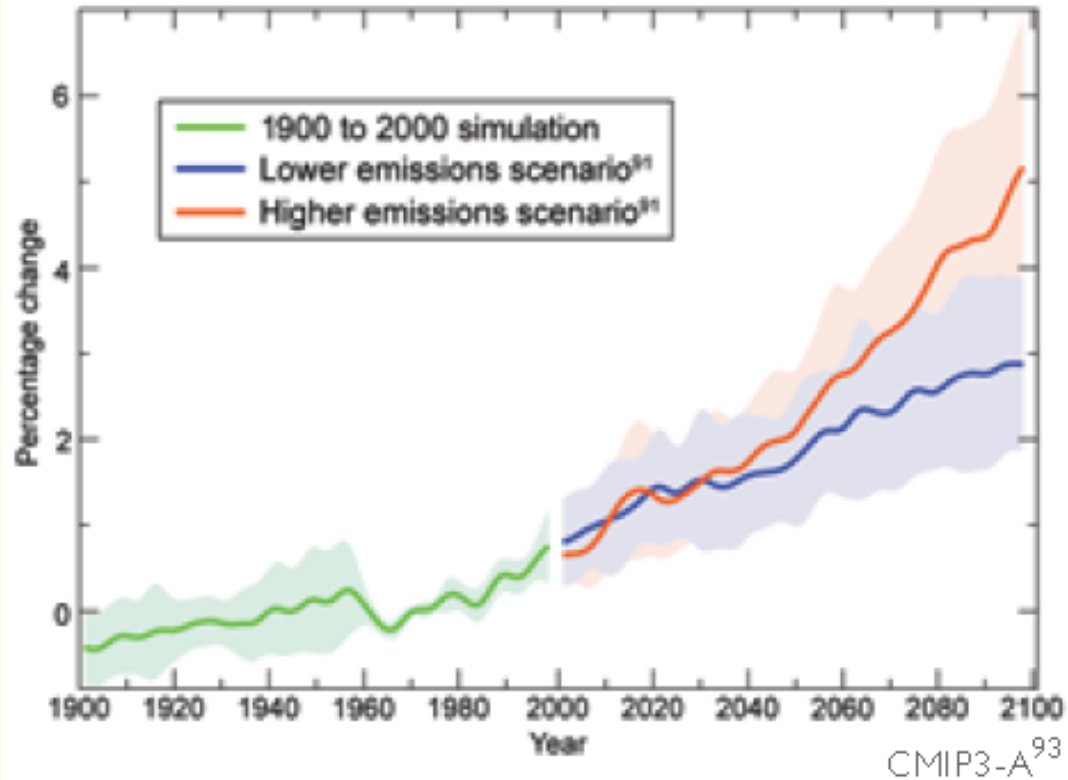


Variations in Earth's Average Surface Temperature Over the Past 20,000 Years


Global Temperature and Carbon Dioxide
Global Temperature (°F)
58.5
58.0
57.5
57.0
56.5
400
380
360
340
320
300
280
260
CO2 Concentration (ppm)
CO2 Concentration
1880
1900
1920
1940
1960
1980
2000
Year
NOAA/NCDC


Global Average Temperature
1900 to 2100
1900 to 2008 observations
1900 to 2000 simulation
Lower emissions scenario[91]
Higher emissions scenario[91]
Even higher emissions scenario[91]
Degrees Fahrenheit
8
6
4
2
0
-2
1900
1925
1950
1975
2000
2025
2050
2075
2100
Year
Smith et al.[72]; CMIP3-A[93]

Global Increase in Heavy Precipitation
1900 to 2100



The Ozone

- 3 O2 ⟶ 2 O3 which is **ozone**

The energy in the equation should be gained from ultraviolet light

- If there is a poulation in certin chemical the equation as a result of that decrease in the ozone thickness and ultraviolet light reach the earth in high amount.

These chemical called CSF (**chlorofluorocarbons**)

Remember that ultraviolet light is necessary for vitamin D but in high amounts will lead to cancer

1-What cause the global warming ?

1- carbon dioxide 2- methane

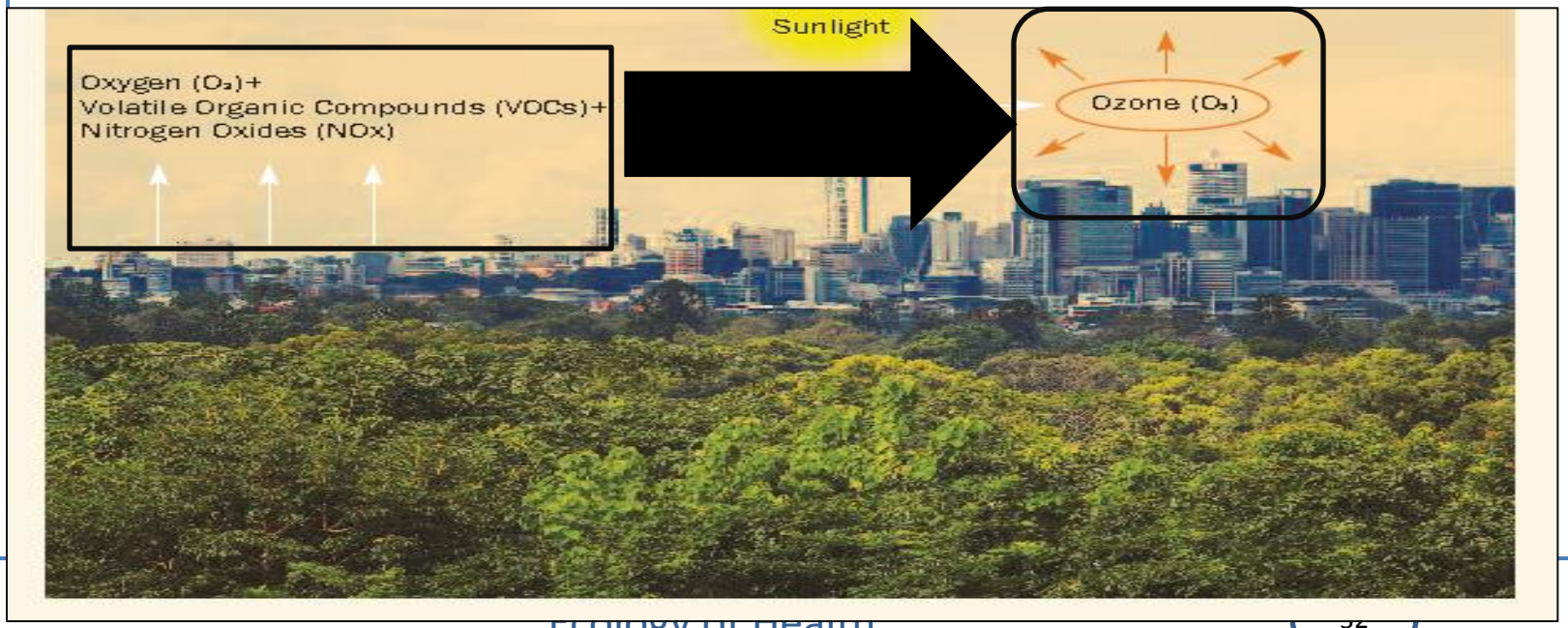
2-what happened when there a an opening or decrease thickness of the ozone hole ?

if that happened the ultraviolet light will reach the skin in high amount which will lead to skin cancer

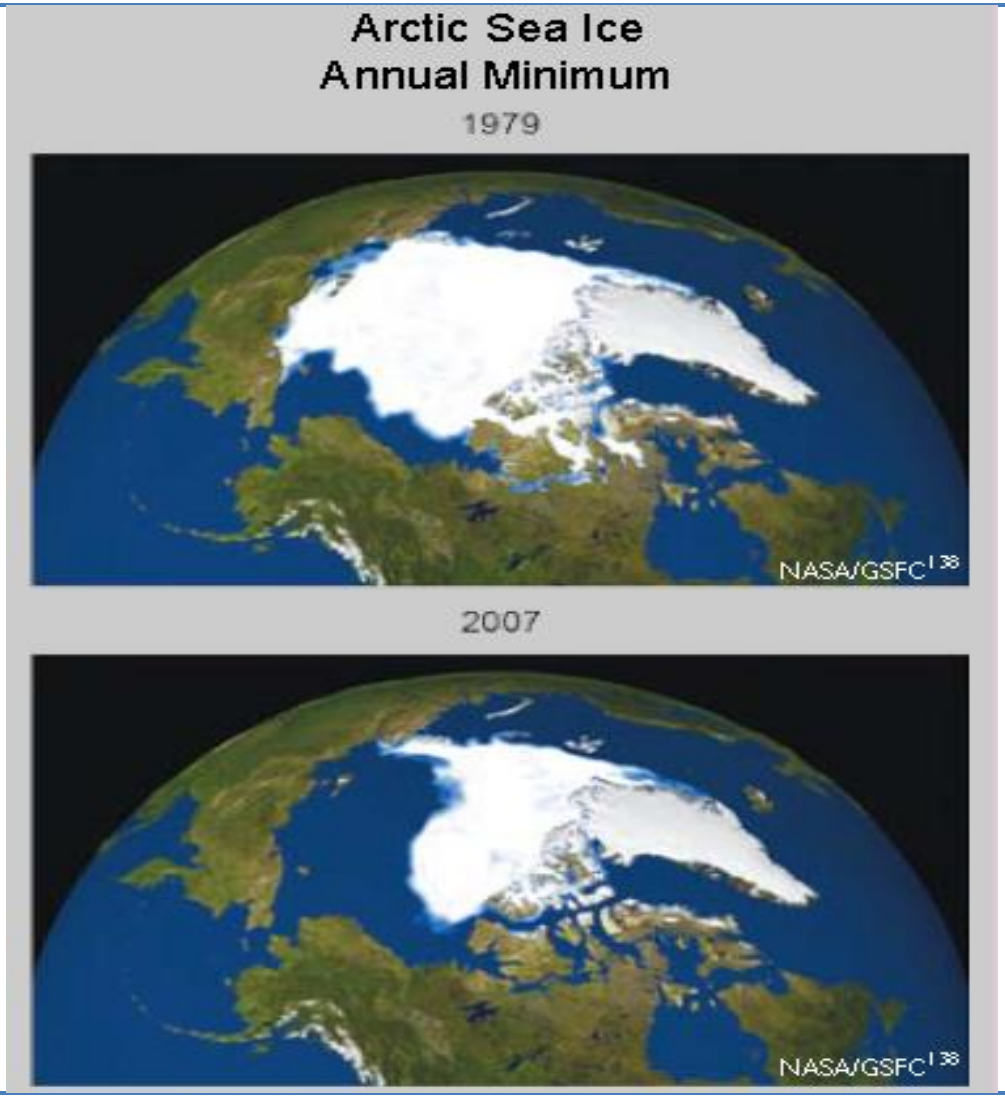
These question is really important the doctor said it will be on your exam

Ground-level Ozone Formation

Ground level or "bad" ozone is not emitted directly into the air, but is created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight. Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the **major sources of NOx and VOC**. Breathing ozone can trigger a variety of health problems, particularly for children, the elderly, and people of all ages who have lung diseases such as asthma



The last two slides are the most important
Pleas make you sure you understand them


Arctic Sea Ice
Annual Minimum
1979
NASA/GSFC
2007
NASA/GSFC

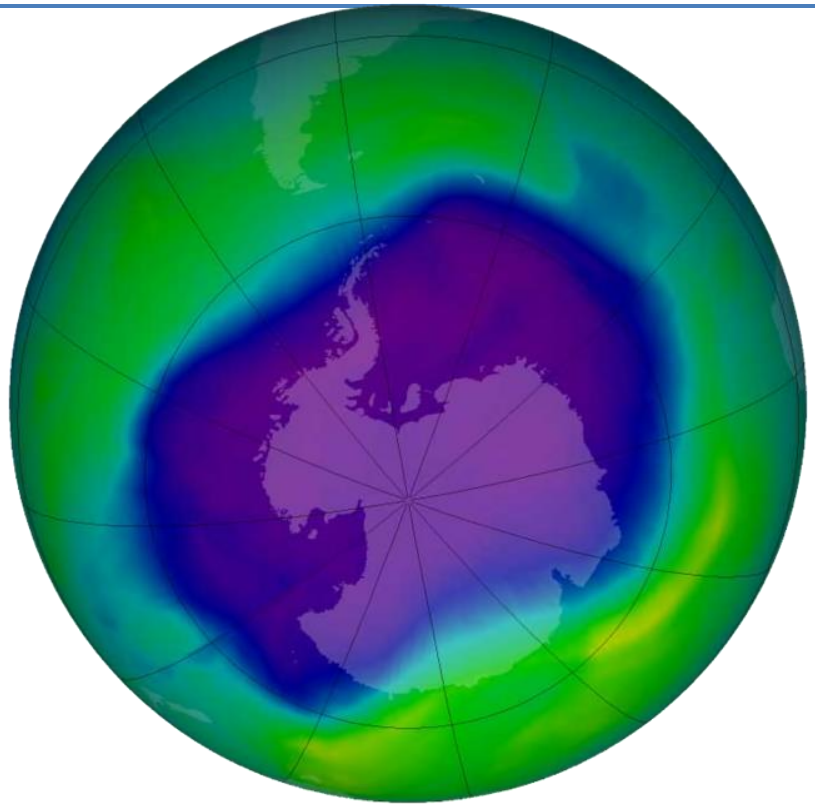
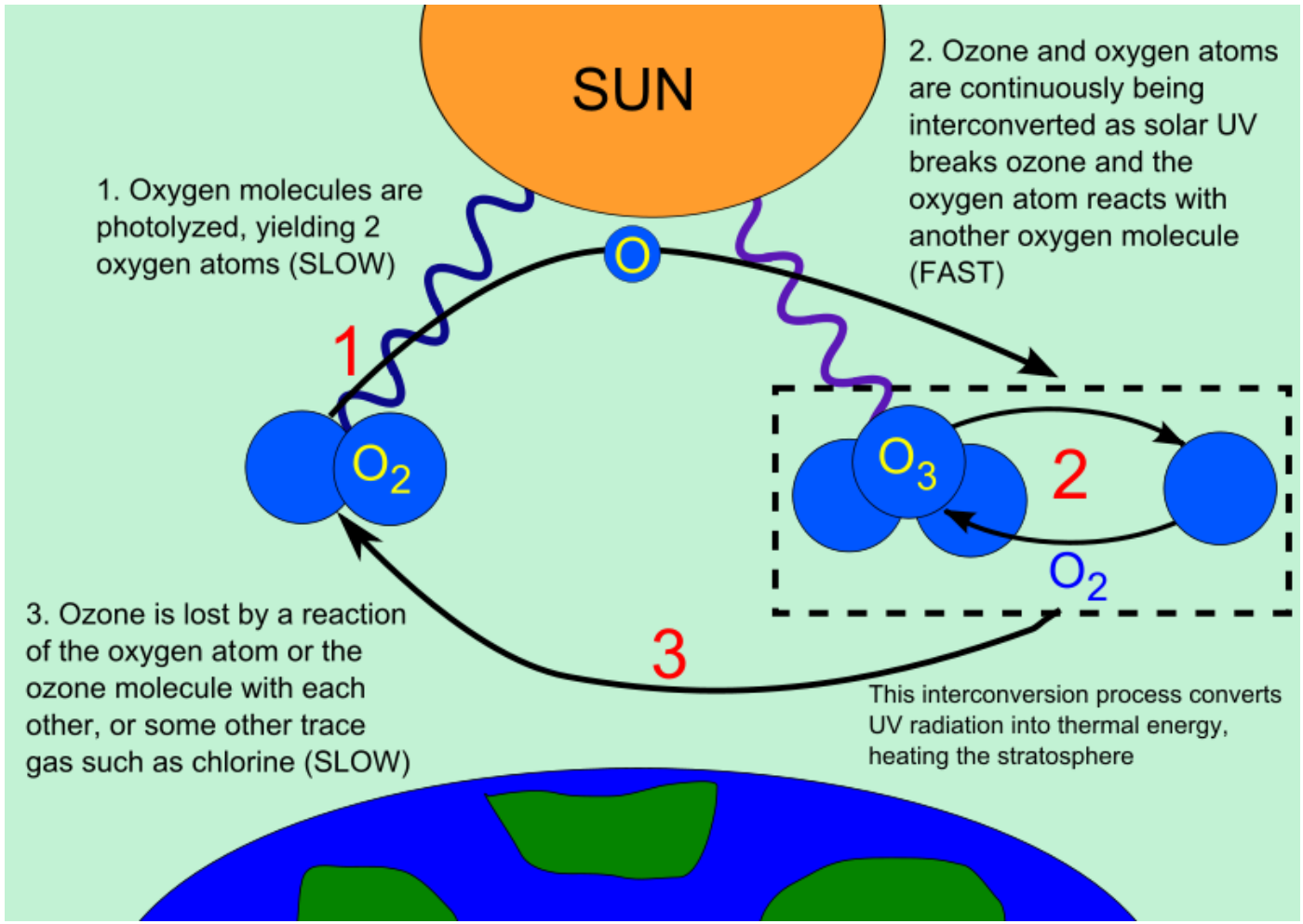
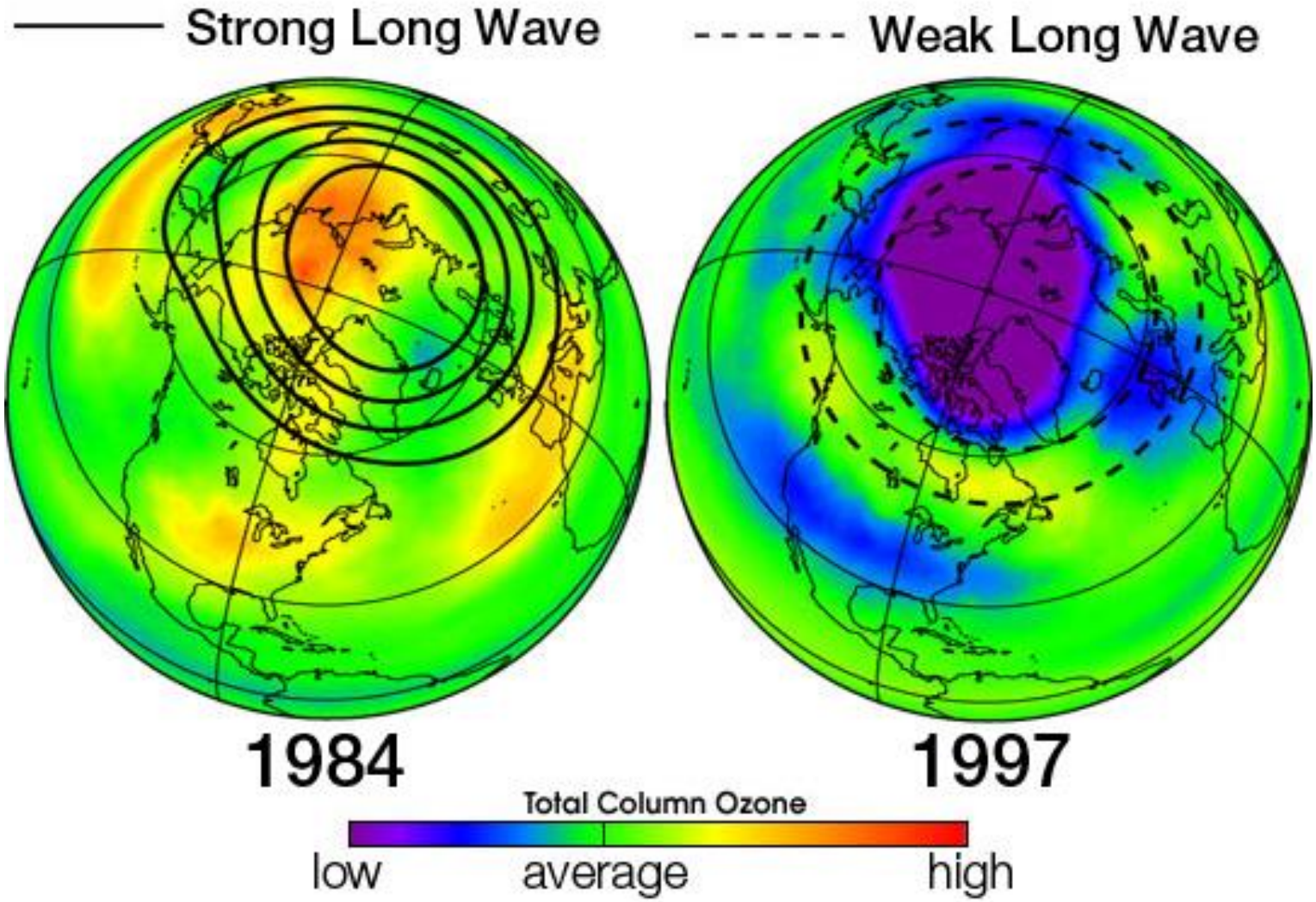


Image of the largest Antarctic ozone hole ever recorded (September 2006), over the Southern pole


SUN
2. Ozone and oxygen atoms are continuously being interconverted as solar UV breaks ozone and the oxygen atom reacts with another oxygen molecule (FAST)
1. Oxygen molecules are photolyzed, yielding 2 oxygen atoms (SLOW)
O
1
O_2
O_3
2
O_2
3
3. Ozone is lost by a reaction of the oxygen atom or the ozone molecule with each other, or some other trace gas such as chlorine (SLOW)
This interconversion process converts UV radiation into thermal energy, heating the stratosphere


Strong Long Wave
Weak Long Wave
1984
1997
Total Column Ozone
low
average
high

Categories of human health consequences of climate change:

1. Asthma, Respiratory Allergies, and Airway Diseases
2. Cancer
3. Cardiovascular Disease and Stroke
4. Foodborne Diseases and Nutrition
5. Heat-Related Morbidity and Mortality
6. Human Developmental Effects
7. Mental Health and Stress-Related Disorders
8. Neurological Diseases and Disorders
9. Vectorborne and Zoonotic Diseases
10. Waterborne Diseases

- **Disaster** preparedness and response.

- **Food safety**,

including in agriculture, transportation, food processing(food making), wholesale and retail distribution and sale.

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. (Any material with the ability to harm is considered hazardous)

- **Housing**, including substandard housing abatement (Appropriate ventilation and sunlight are important in schools and houses)
- **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.

- **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.

(Most of the infections from swimming pools are fungal)
(The chlorine used for cleaning the pools is hazardous by itself)

- **Safe drinking water.**

Solid waste management, including landfills, recycling facilities, composting and solid waste transfer stations.

- **Toxic chemical exposure** whether in consumer products, housing, workplaces, air, water or soil.

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).

END OF LECTURE 1

EXAMPLE I: Air quality

primary pollutants include:
(works by its own)

•Nitrogen oxides (NOx) - especially nitrogen Carbon monoxide - is a colorless, odorless, non-irritating but very poisonous gas

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

(One of the most dangerous air pollutants is carbon monoxide; colorless gas produced by the vehicles and fire) (Prevents the binding of oxygen to hemoglobin)

- Particulate matter- Particulates, alternatively referred to as particulate matter (PM) or fine particles, are tiny particles of solid or liquid suspended in a gas.
- Toxic metals, such as lead, cadmium and copper.

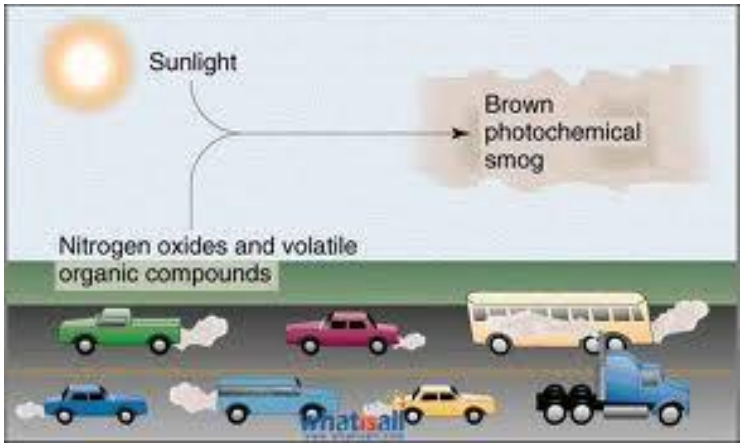
- Chlorofluorocarbons (CFCs) - harmful to the ozone layer emitted from products currently banned from use.

- Ammonia (NH_3) - emitted from agricultural processes.

Secondary pollutants

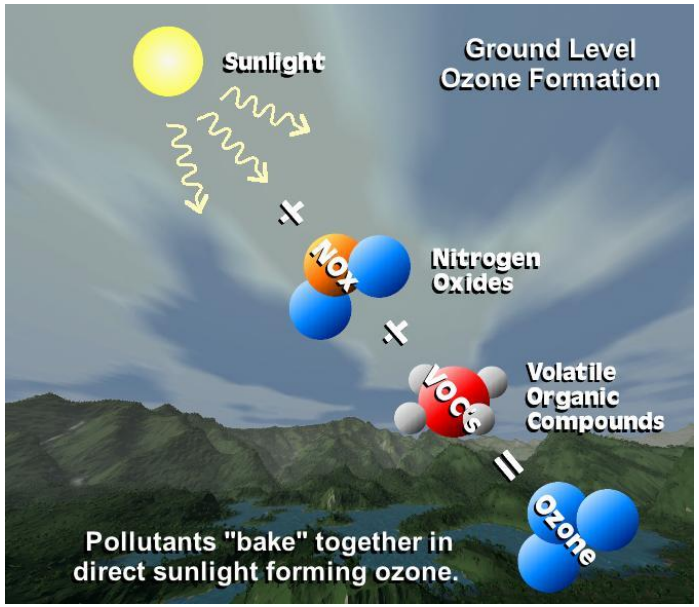
are not emitted directly. Rather, they form in the air when primary pollutants react or interact. include:

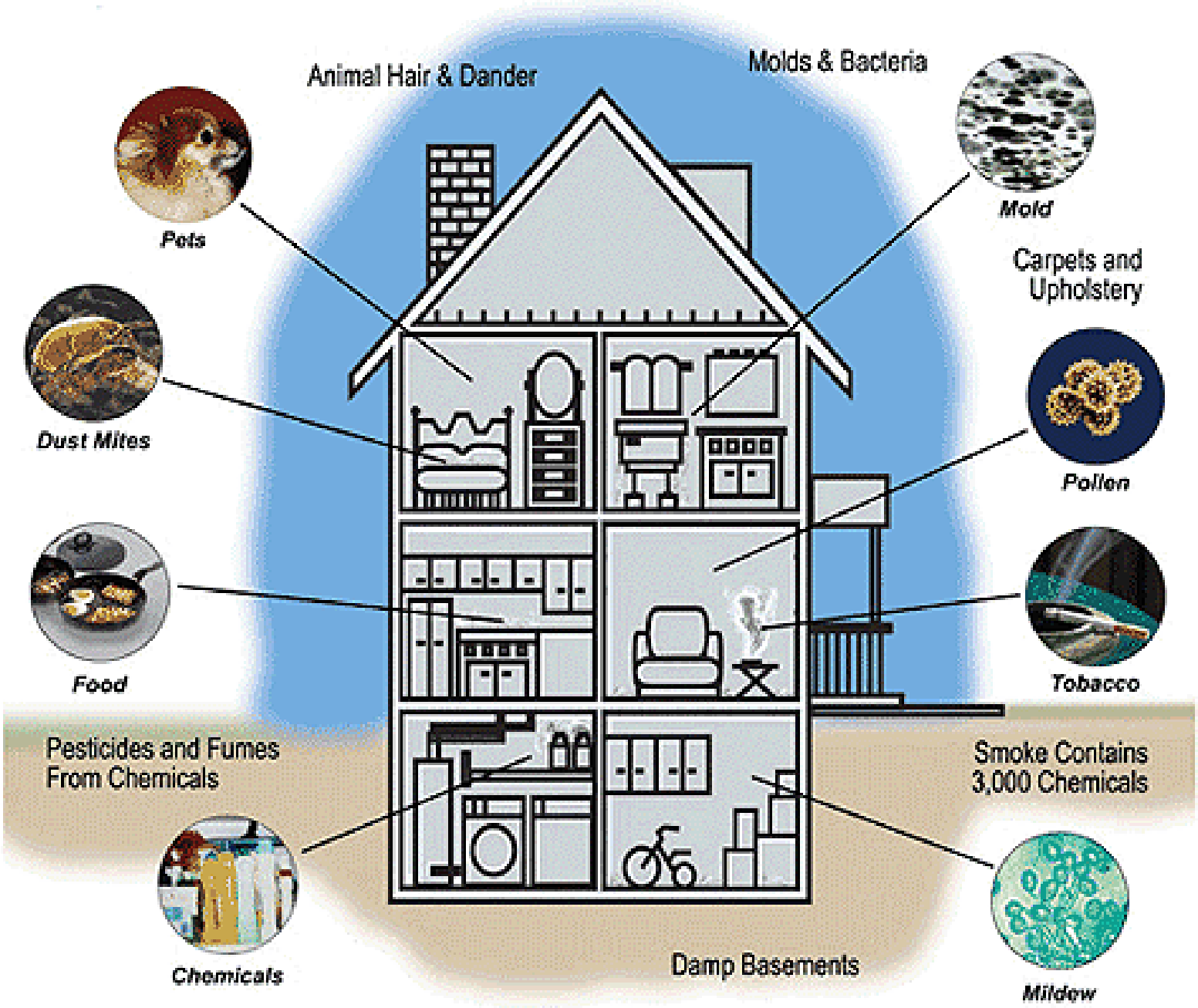
- Particulate matter formed from gaseous primary pollutants and compounds in photochemical smog.



Secondary pollutants

- Ground level ozone (O3) formed from NOx and VOCs. Ozone (O3) is a key constituent of the troposphere.




Animal Hair & Dander
Molds & Bacteria
Pets
Mold
Carpets and Upholstery
Dust Mites
Pollen
Food
Tobacco
Pesticides and Fumes From Chemicals
Smoke Contains 3,000 Chemicals
Chemicals
Damp Basements
Mildew

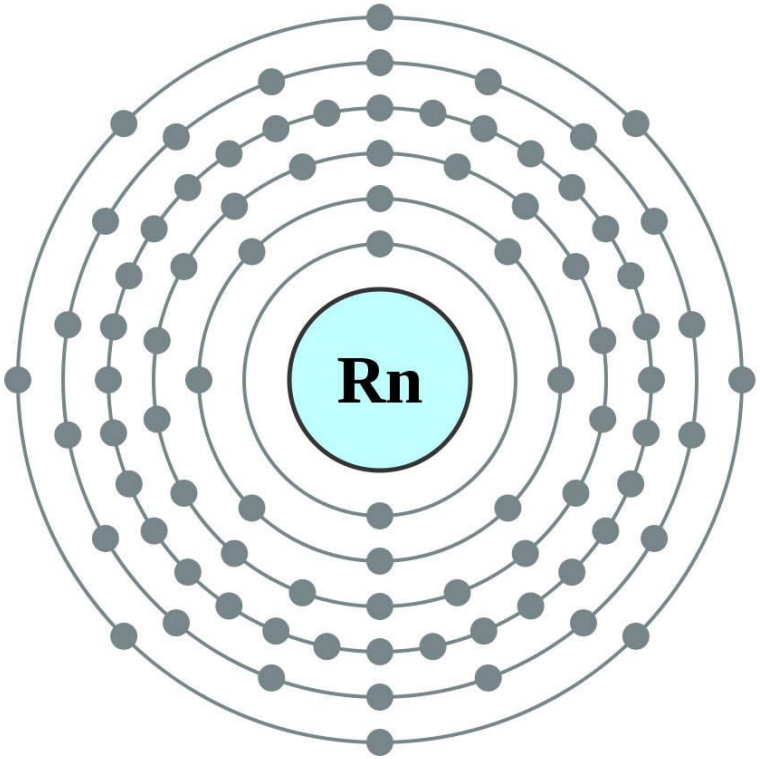
SECOND-HAND SMOKE

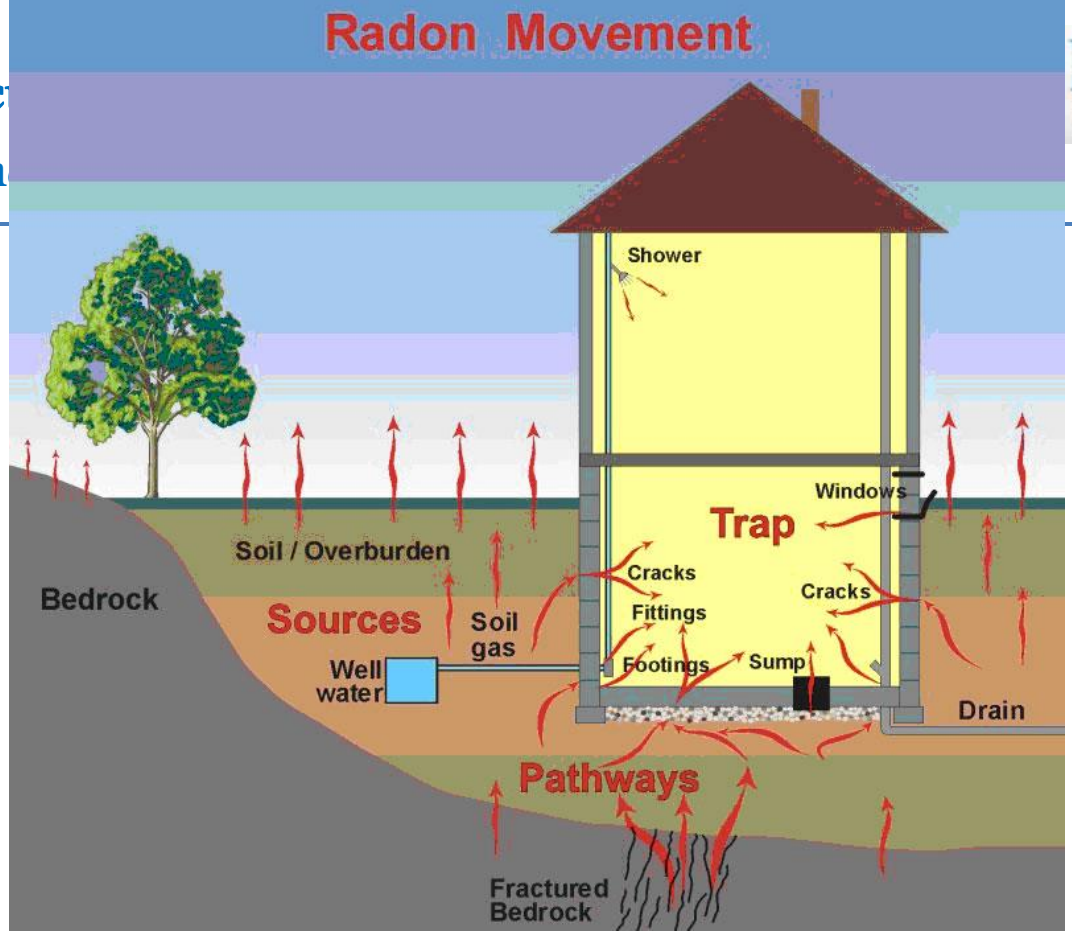
Second-hand smoke is tobacco smoke which affects persons other than the 'active' smoker.
(Not mentioned by the doctor)

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.

86: Radon **2,8,18,32,18,8**





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.

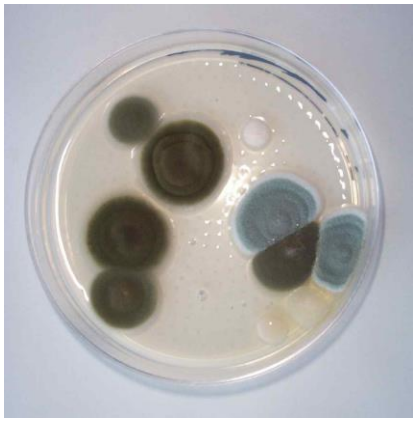
MOULDS AND OTHER ALLERGENS

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.

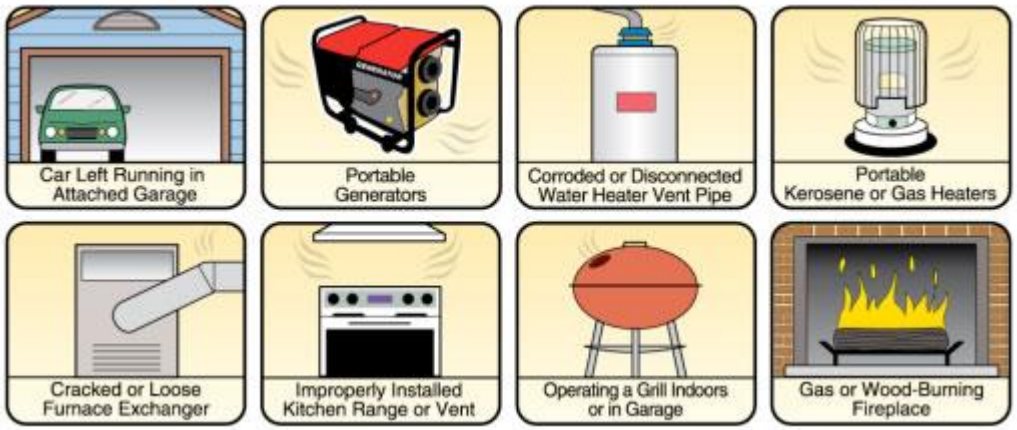
There are some varieties of mould that contain toxic compounds (**mycotoxins**).



CARBON MONOXIDE

A colorless, odorless gas that is a byproduct of incomplete combustion of fossil fuels.

(Where is carbon Monoxide found?)



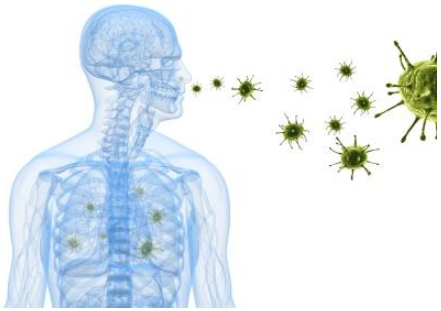
Common sources of carbon monoxide are tobacco smoke, space heaters using fossil fuels, defective central heating furnaces and automobile exhaust.

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.

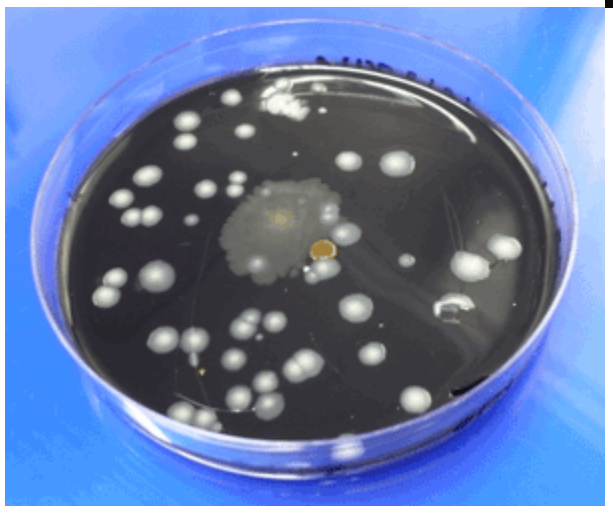
LEGIONELLA



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.

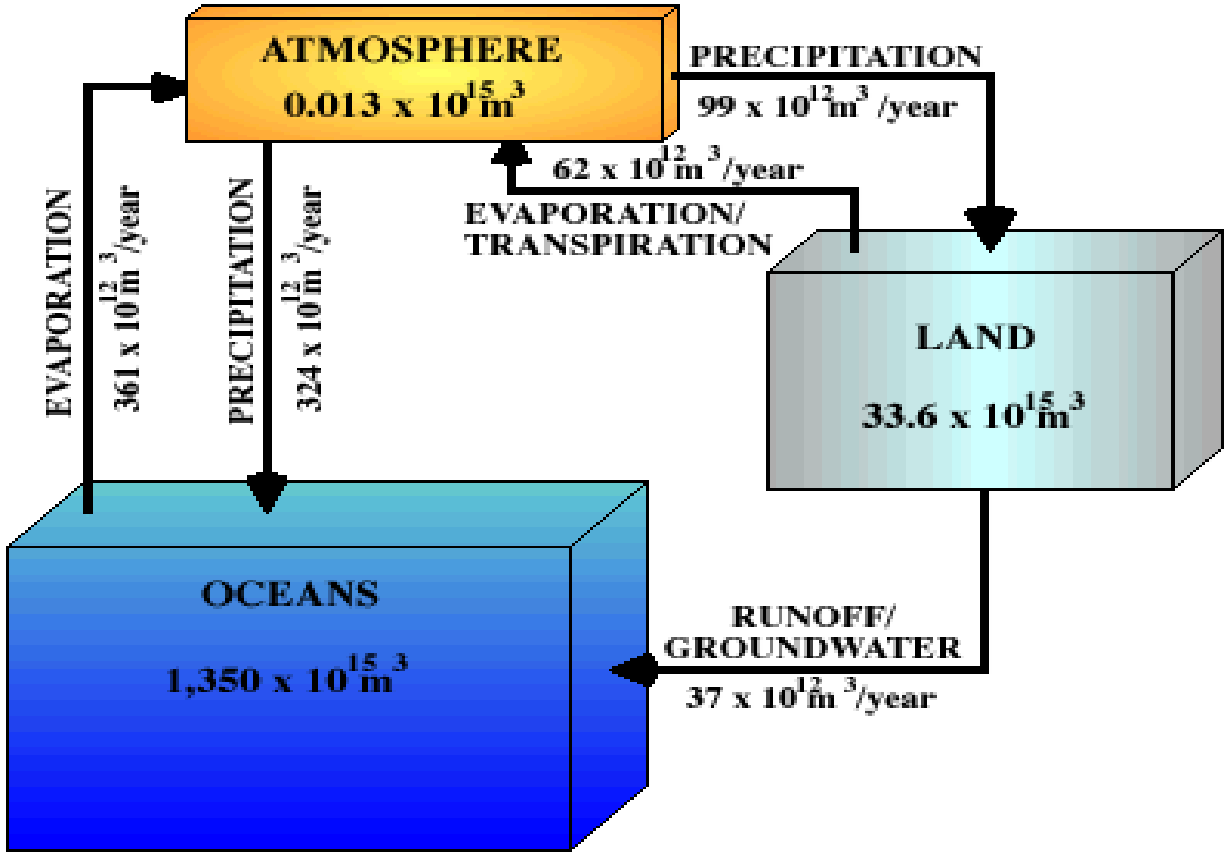
Legionella testing typically involves collecting water samples and surface swabs from evaporative cooling basins, shower heads, and other locations where warm water collects

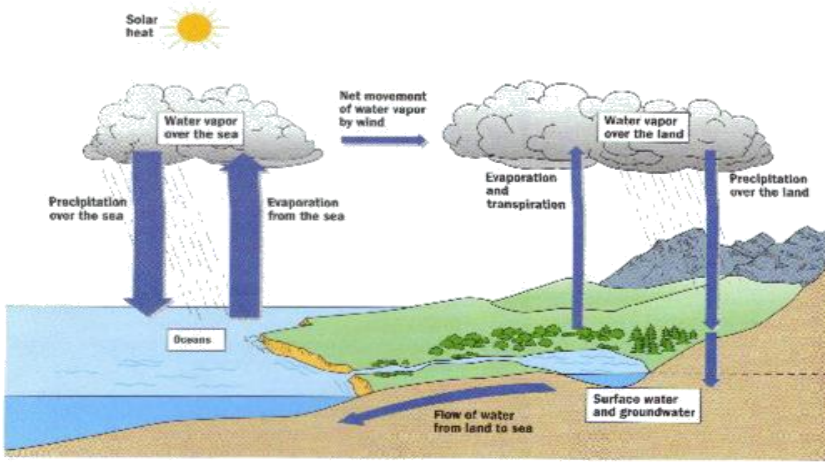


ASBESTOS FIBRES

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

EXAMPLE II: WATER:



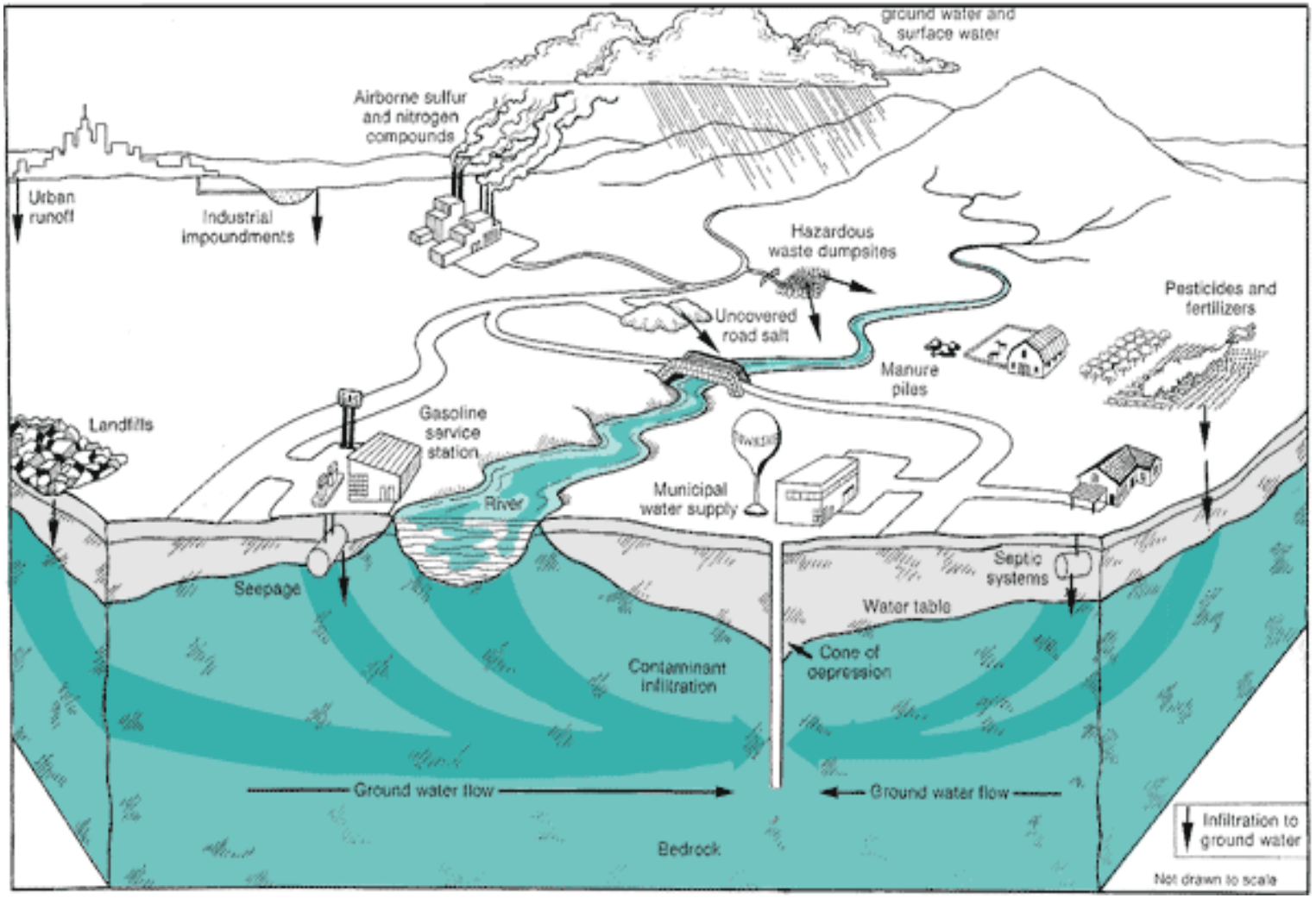


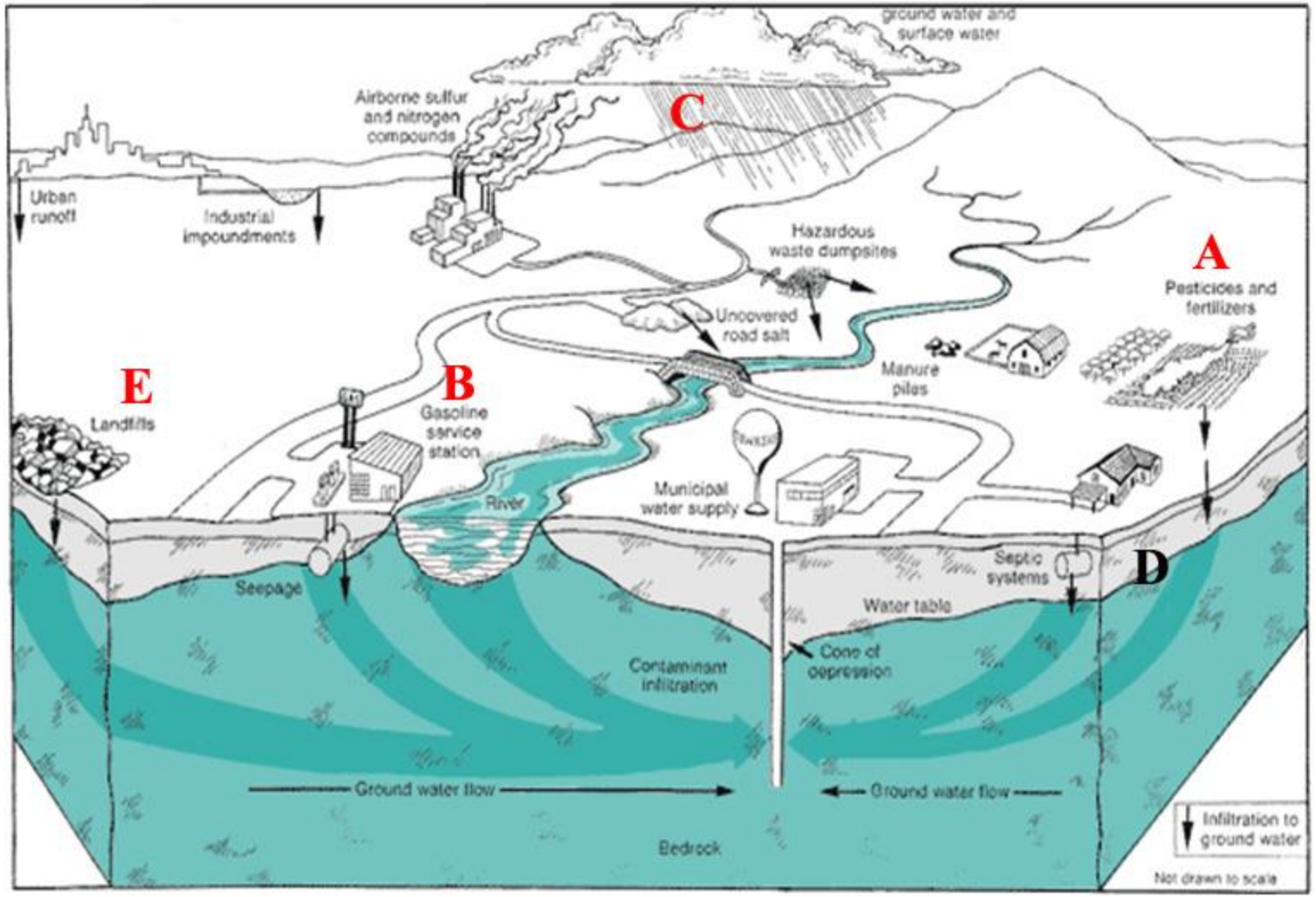
- Evaporation and Transpiration
- Condensation and Precipitation
- Runoff and infiltration
- Streams
- Groundwater – held in aquifers

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

(Hazardous materials and pollutants affect the groundwater not the rain's)


ground water and surface water
Airborne sulfur and nitrogen compounds
Urban runoff
Industrial impoundments
Hazardous waste dumpsites
Uncovered road salt
Pesticides and fertilizers
Manure piles
Landfills
Gasoline service station
River
Municipal water supply
Septic systems
Seepage
Water table
Cone of depression
Contaminant infiltration
Ground water flow
Ground water flow
Bedrock
Infiltration to ground water
Not drawn to scale


ground water and surface water
Airborne sulfur and nitrogen compounds
C
Urban runoff
Industrial impoundments
Hazardous waste dumpsites
A
Pesticides and fertilizers
Uncovered road salt
Manure piles
E
Landfills
B
Gasoline service station
River
Municipal water supply
Septic systems
D
Seepage
Water table
Cone of depression
Contaminant infiltration
Ground water flow
Ground water flow
Bedrock
Infiltration to ground water
Not drawn to scale

Water Disinfection

(Chorine gas is not odorless, and it's heavier than the air)

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

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 Cl2 as:

a. Chlorinated lime = Bleaching powder, 25-35% Cl2

b. HTH = High test hypochlorite powder, 70-75% Cl2.

c. Sodium hypochlorite solution, 15% Cl2

(Sodium hypochlorite is the one used in homes for cleaning)

(mg/l = g/m^3)

(These calculations are **important**)

(Leave the swimming pools for 30 min after using the chlorine)

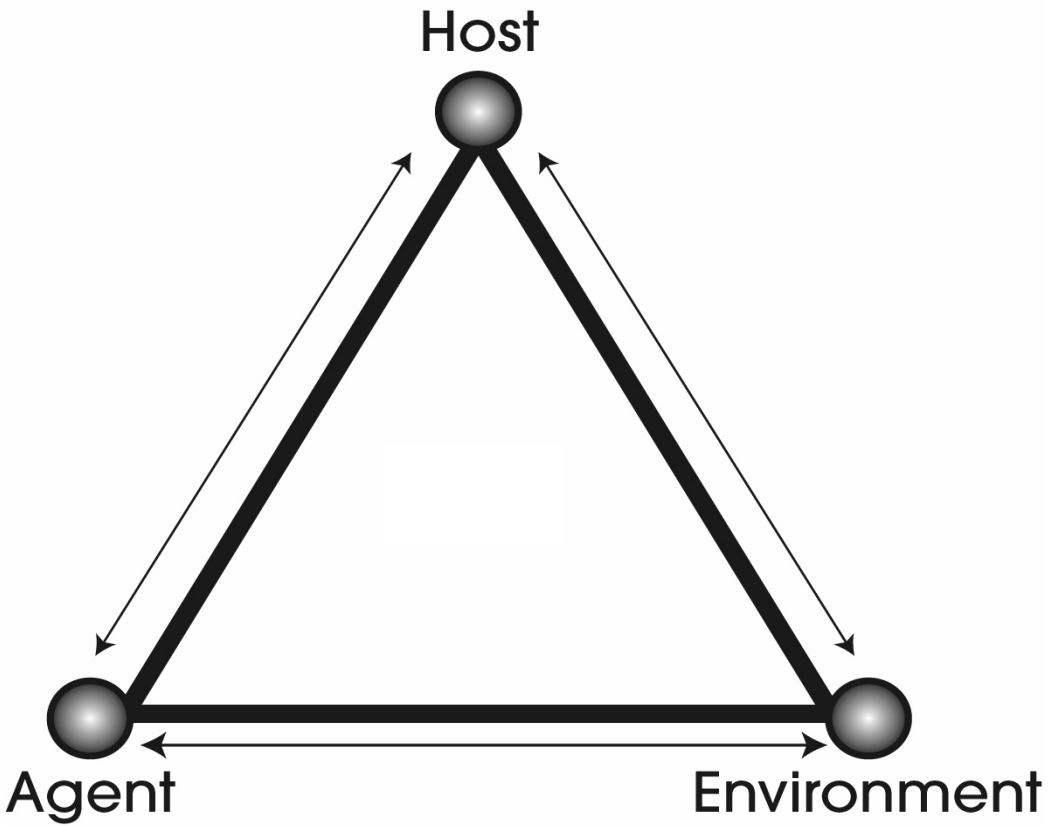
Ex. **Water quantity = 100 m^3/day.**
Residual Cl_2 required = 0.5 ppm
Cl_2 demand = 0.6 ppm
Cl_2 dose = 1.1 ppm

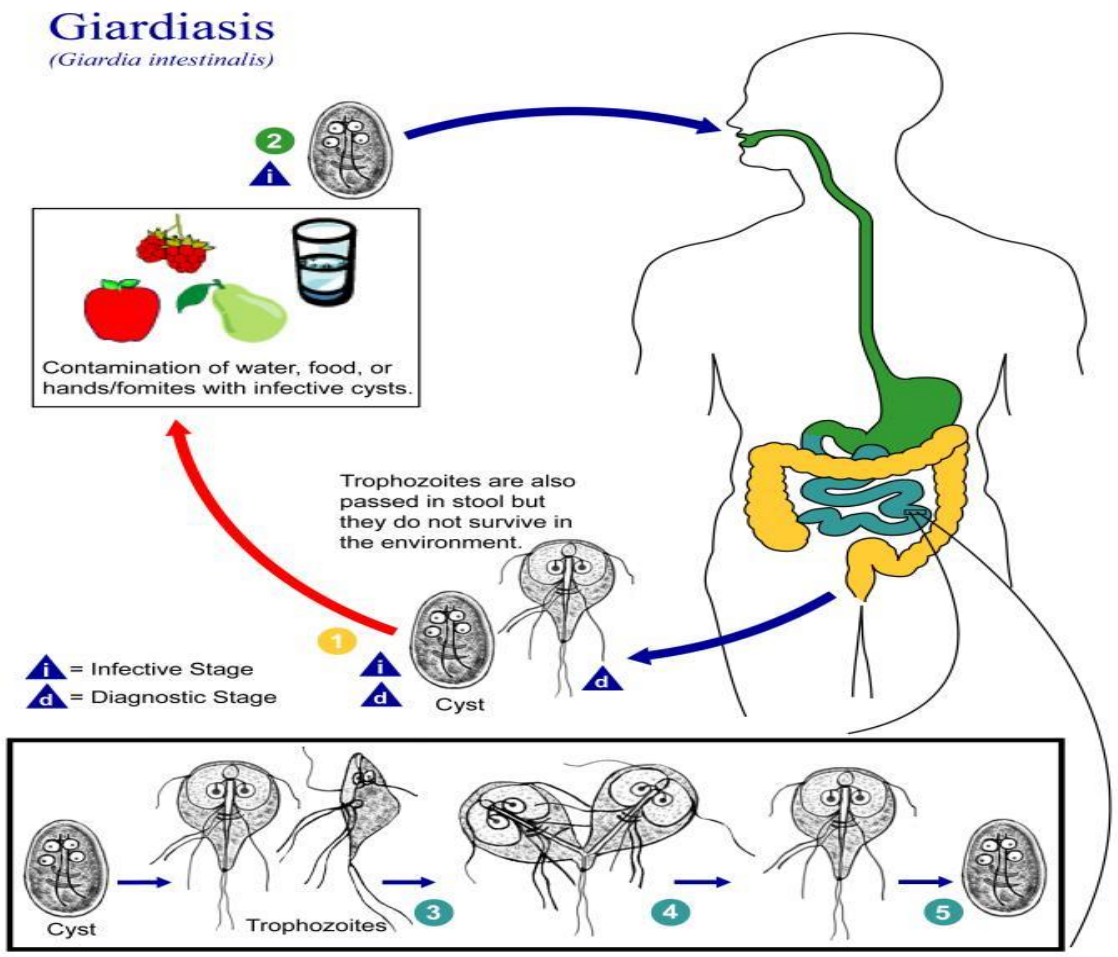
So every 1 m^3 needs 1.1 gm CI_2
100 m3 need 100 x 1.1 = 110 gm Cl_2/day
for one month 110 x 30 = 3300 gm Cl_2
Every 1 gm of HTH contains 0.75 gm CI_2

$$\text{So amount of HTH needed} = \frac{100 \times 1.1 \times 30}{0.75} = 4400 \text{ gm HTH / month}$$

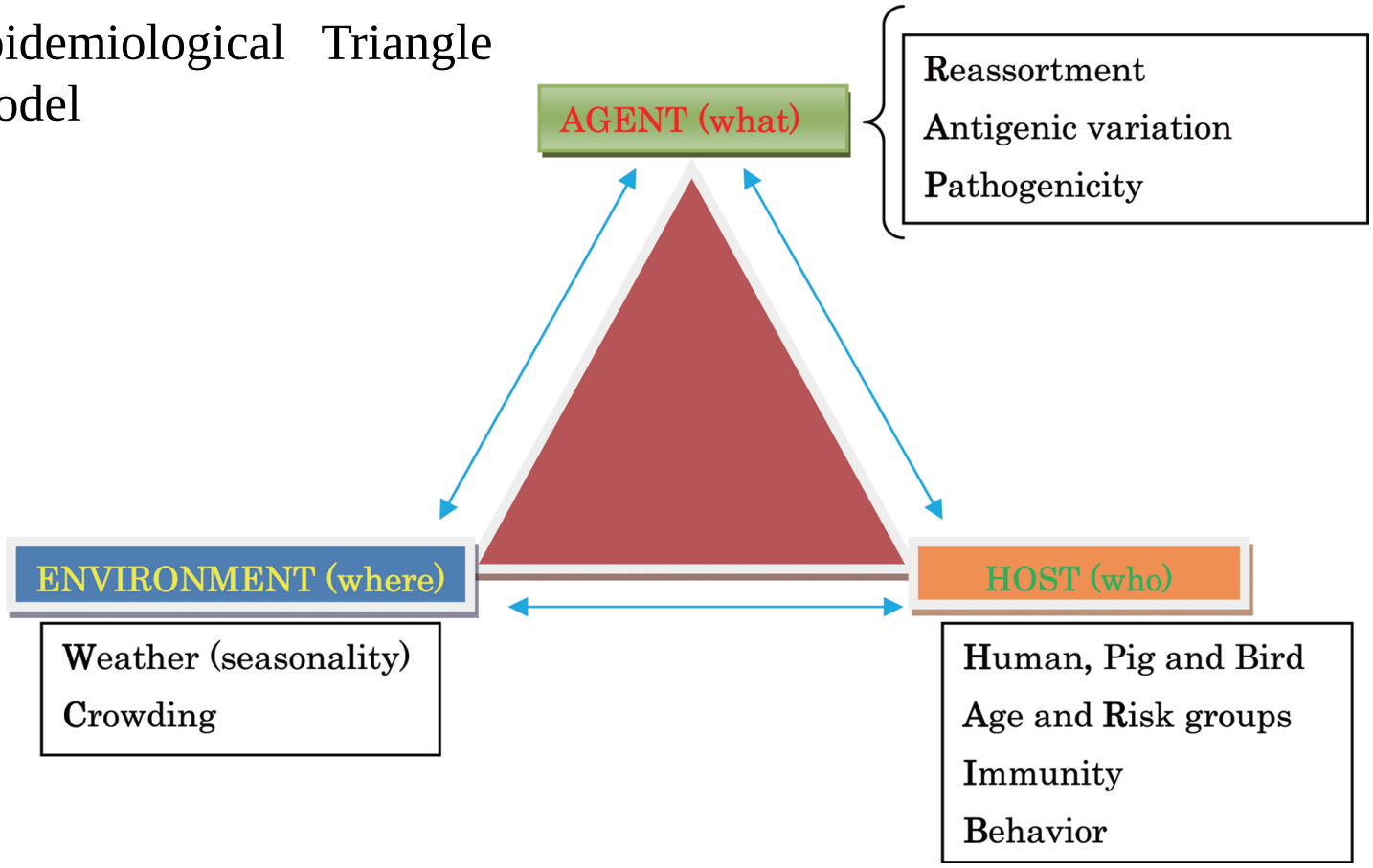
= 4.4 Kg HTH / month

1.5. Epidemiologic Triangle




Giardiasis
(Giardia intestinalis)
2
i
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 = Infective Stage
d = Diagnostic Stage
i
d
Cyst
d
Cyst
Trophozoites
3
4
5

•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	-	-	💣	💣💣	💣💣

MCQs

17. Which tiny particles of the following are defined as particulate matter?

a. Solid suspended as dust.
b. Solid or liquid suspended in a gas.
c. Bacteria suspended in air
d. Asbestos suspended in air.

18. Which of the following is a primary contributor to the ozone hole?

a. Carbon dioxide
b. Carbon monoxide
c. Chlorofluorocarbons
d. Methane gas

19. What are the biological consequences of ozone depletion?

a. Increased oral cancer, central cataracts, reduction of animal populations
b. Increased lung cancer, glaucoma, reduction of younger populations
c. Increased skin cancer, cortical cataracts, reduction of plankton populations
d. Increased laryngeal cancer, glaucomatous cataracts, reduction of different populations

21. What is the most serious environmental effect posed by hazardous wastes?

a. Air pollution
b. Contamination of groundwater
c. Increased use of land for landfills
d. Destruction of habitat

1- **Climate changes is the accumulating effect of the following:**
   a- Greenhouse effect
   b- Release of CO
   c- Release of chlorofluorocarbons
   d- Release of CFC gases and VOCs

2- **Which of the following is not true:**
   a- (NO) is non-irritating but very poisonous gas
   b- Ammonia (NH3) is a primary air pollutant which may emit from Deepwater wells and natural springs.
   c- Particulate matters (PM) is tiny particles of solid or liquids suspended in a gas
   d- Chlorofluorocarbons are gases which are harmful to the ozone layer.

3- **Ground level ozone (O3) formed from NOx and VOCs can be classified as:**
   a- Secondary pollutants
   b- Particulate matter
   c- harmful to the ozone layer

4- **exposures to chemicals such as chlorine or ammonia gas may have a reaction delay of:**
   a- some six to twelve hours
   b- weeks to months
   c- instantaneous
   d- less than one year

5- **the Minamata disaster in japan b/w 1932 and 1968 was due to**
   a- Methylmercury released in factory wastewater
   b- Ammonium fertilizer effect
   c- methyl isocyanate leakage
   d- nuclear power plant explosion

6- **all are internal factors affect workers except:**
   a- worker health
   b- worker age
   c- disability due to hormonal deficiency
   d- worker genetics

7- **which of the following is not a primary contributor to the greenhouse effect:**

a- CO_2

b- CO

c- Chlorofluorocarbons

d- Methane gas

8- **Biological consequences of ozone depletion include:**

a- **Increased oral cancer, central cataract**

b- Increased lung cancer, glaucoma

c- Increased skin cancer, cortical cataract

d- Increased laryngeal cancer

9- The most serious environmental effect posed by hazardous wastes is

a- Air pollution
b- Contamination of groundwater
c- Increased use of land for landfills
d- Destruction of habitat

10- The potential for risk can measured through the following equation:

a- Potential = hazard × sensitivity
b- Potential = hazard × severity × frequency
c- Importance = severity × frequency
d- Importance = sensitivity × frequency

Best of luck,

Abdulrahman Alrajhi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THANK YOU