Air Pollution:

Definition, Sources, and Effects

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Air Pollution

Air Pollution Definitions

- Transfer of harmful and/or of Natural/Synthetic materials into the atmosphere as a direct/indirect consequences of human activity (OECD).

- The introduction of chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or damages the natural environment into the atmosphere

- The overwhelming scientific consensus is that the earth's atmosphere is warming rapidly, mostly because of human activities, and that this will lead to significant climate change during this century

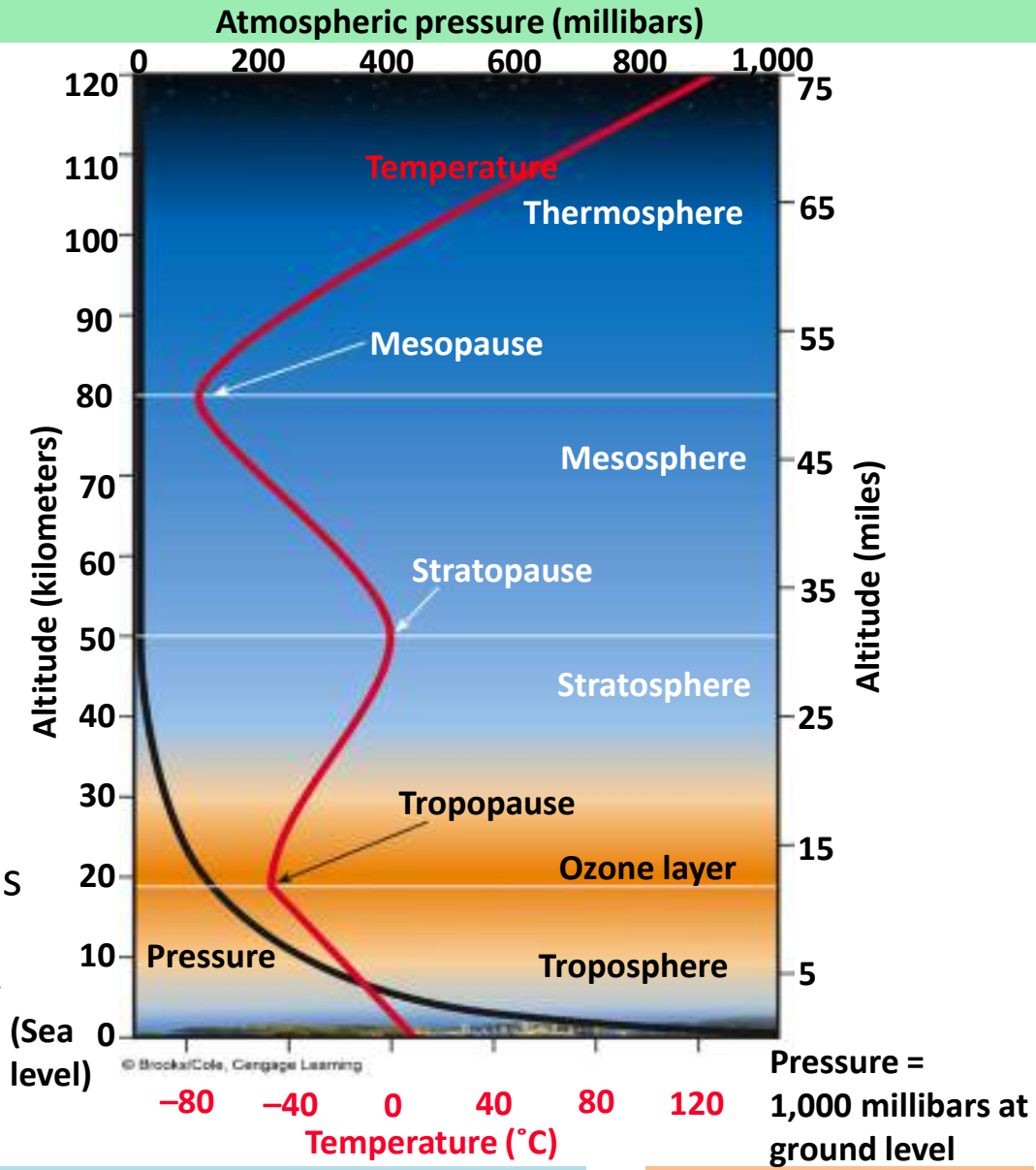
Earth's atmosphere

❑ Troposphere

- 75–80% of the earth's air mass
- Closet to the earth's surface
- Chemical composition of air
- Rising and falling air currents:
  weather and climate
- Involved in chemical cycling

❑ Stratosphere

- Similar composition to the troposphere, with 2 exceptions
  - ➢ Much less water
  - ➢ O_3, **ozone layer,** filters UV



Air Pollutants

- Pollutants mix in the air to form industrial smog, mostly the result of burning coal, and photochemical smog, caused by motor vehicle, industrial, and power plant emissions

- An air pollutant can be a gas or a particulate.

- Sources:

  - Natural sources
    - ✓ Dust blown by wind
    - ✓ Pollutants from wildfires and volcanoes
    - ✓ Volatile organics released by plants

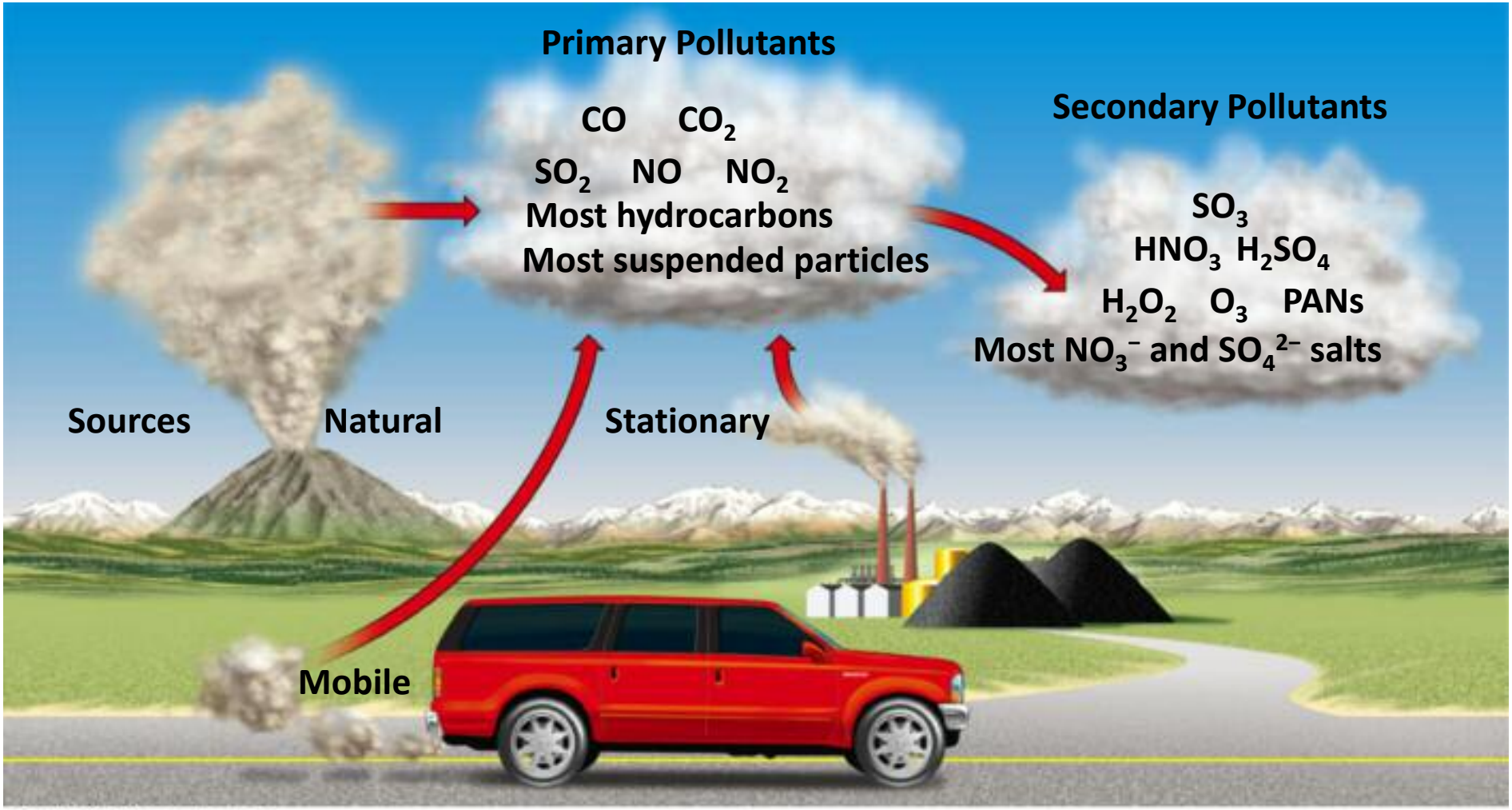
  - Human sources: mostly in industrialized and/or urban areas
    - ✓ Stationary sources
    - ✓ Mobile sources

Air Pollutants Classification

Classified as:

1. **Primary pollutants:** foreign matter injected into the atmosphere by human activities.

2. **Secondary pollutants*:*** resulting from chemical transformations, typically with primary pollutants and (often) sunlight.


Primary Pollutants
CO CO_2
SO_2 NO NO_2
Most hydrocarbons
Most suspended particles
Secondary Pollutants
SO_3
HNO_3 H_2SO_4
H_2O_2 O_3 PANs
Most NO_3^- and SO_4^{2-} salts
Sources
Natural
Stationary
Mobile
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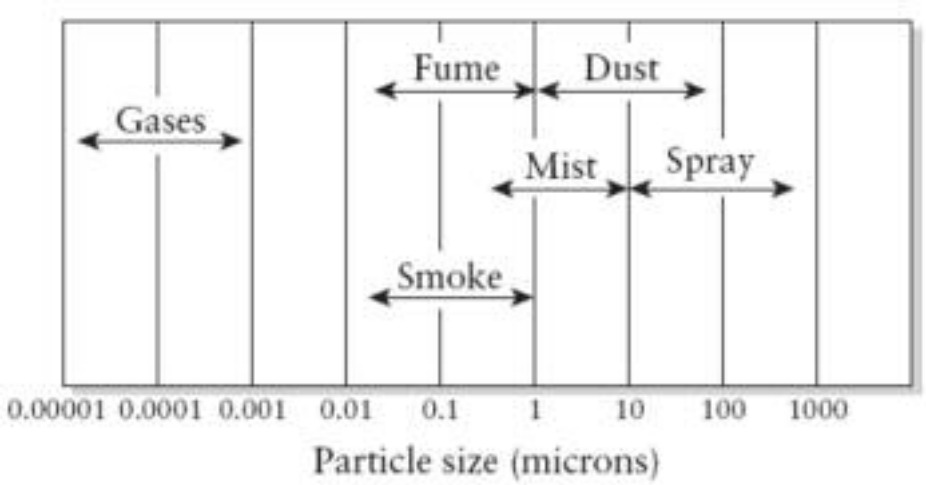
Major Air Pollutants

Suspended particulate matter (SPM):

- Consists of a variety of solid particles and liquid droplets small and light enough to remain suspended in the air.
- The most harmful forms of SPM are fine particles (PM-10, with an average diameter < 10 micrometers) and ultrafine particles (PM-2.5).
- According to the EPA, SPM is responsible for about 60,000 premature deaths a year in the U.S.

Major Air Pollutants

- Particulate matter or pollutants can be further classified as dusts, fumes, mists, smoke, or spray.



Terminology	Abbreviation	Diameter Range (μm)
Ultrafine	–	<0.1
Fine	$PM_{2.5}$	<2.5
Coarse	PM_{10}	2.5–10

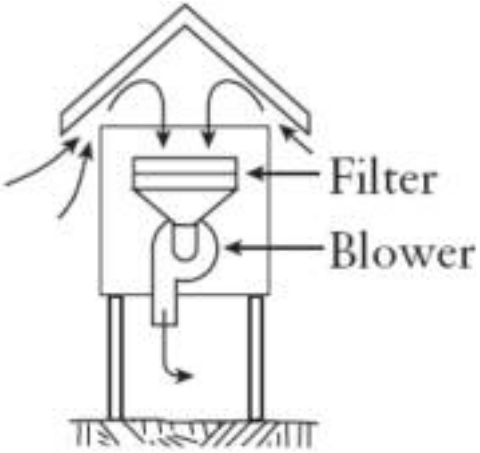
Particulate Matters

- Dust is defined as solid particles.
- A fume is also a solid particle, frequently a metallic oxide, formed by the condensation of vapors by sublimation, distillation, calcination, or chemical reaction processes. The particles in fumes are quite small, with diameters from 0.03 to 0.3 μ.
- A mist is an entrained liquid particle formed by the condensation of a vapor and perhaps by chemical reaction. Mists typically range from 0.5 to 3.0 μ in diameter.
- Smoke is made up of entrained solid particles formed as a result of incomplete combustion of carbonaceous materials. Smoke particles have diameters from 0.05 to approximately 1 μ.
- a spray is a liquid particle formed by the atomization of a parent liquid. Sprays settle under gravity

Measurement of Particulates

- The measurement of PM10 has been historically done by using the *high-volume sampler* (or hi-vol).

- The high-volume sampler operates much like a vacuum cleaner, forcing up to 86,000 ft3 of air through a filter in 24 hr. The analysis is gravimetric; the filter is weighed before and after, and the difference is the particulates collected.



Gaseous Pollutants

- Gaseous pollutants include substances that are gases at normal temperature and pressure as well as vapors of substances that are liquid or solid at normal temperature and pressure.

Name	Formula	Properties of Importance	Significance as Air Pollutant
Sulfur dioxide	SO_2	Colorless gas, intense choking, odor, highly soluble in water—forming sulfurous acid, H_2SO_3	Damage to property, health, and vegetation
Sulfur trioxide	SO_3	Soluble in water—forming sulfuric acid H_2SO_4	Highly corrosive
Hydrogen sulfide	H_2S	Rotten egg odor at low concentrations, odorless at high concentrations	Highly poisonous
Nitrous oxide	N_2O	Colorless gas, used as carrier gas in aerosol bottles	Relatively inert; not produced in combustion
Nitric oxide	NO	Colorless gas	Produced during high-temperature, high-pressure combustion; oxidizes to NO_2
Nitrogen dioxide	NO_2	Brown to orange gas	Major component in the formation of photochemical smog
Carbon monoxide	CO	Colorless and odorless	Product of incomplete combustion; poisonous
Carbon dioxide	CO_2	Colorless and odorless	Formed during complete combustion; greenhouse gas
Ozone	O_3	Highly reactive	Damage to vegetation and property; produced mainly during the formation of photochemical smog
Hydrocarbons	C_xH_y or HC	Many	Emitted from automobiles and industries; formed in the atmosphere
Methane	CH_4	Combustible, odorless	Greenhouse gas
Chlorofluorocarbons	CFC	Nonreactive, excellent thermal properties	Deplete ozone in upper atmosphere

Air Pollution Effects

- **Effects on Human Health**
  - Respiratory problems
  - Allergies
  - Risk for cancer
- **Effects on the environment**
  - Acid rain (Regional)
  - Ozone depletion (Stratospheric)
  - Greenhouse Effect (Global warming)

Human Health Effects

- Exposure to air pollution is associated with numerous effects on human health, including pulmonary, cardiac, vascular, and neurological impairments.

- The health effects vary greatly from person to person. High-risk groups such as the elderly, infants, pregnant women, and sufferers from chronic heart and lung diseases are more susceptible to air pollution.

- Children are at greater risk because they are generally more exposed to outdoor environment and their lungs are still developing stage.

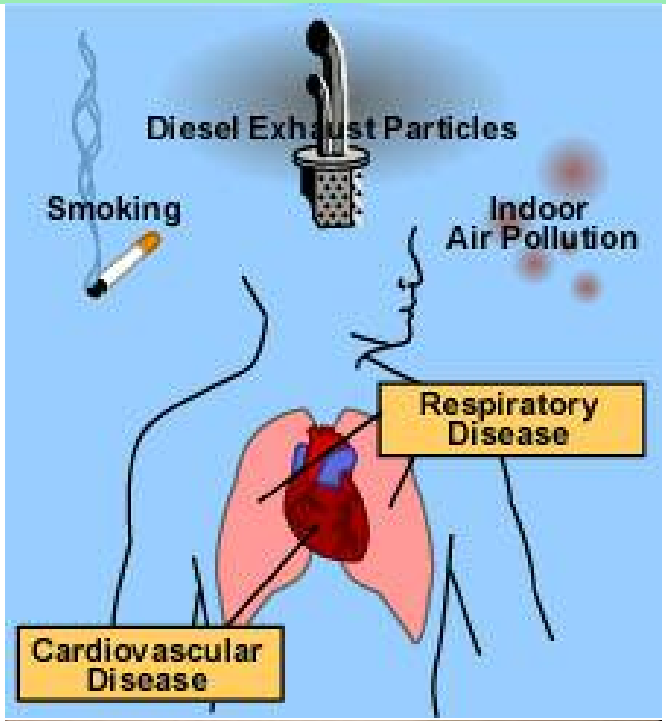


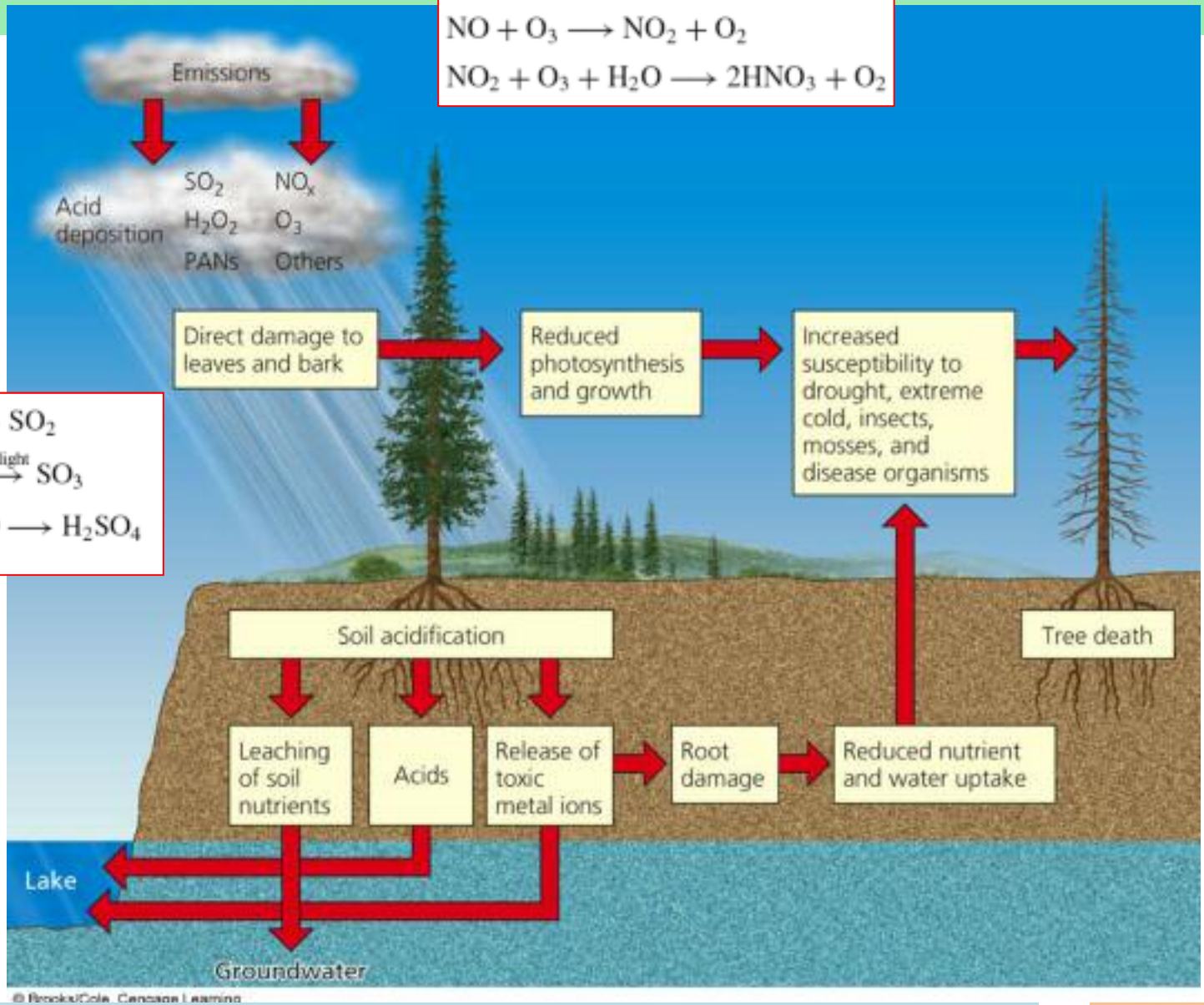
Table 1: Sources, Health and Welfare Effects for Criteria Pollutants.				
Pollutant	**Description**	**Sources**	**Health Effects**	**Welfare Effects**
Carbon Monoxide (CO)	Colorless, odorless gas	Motor vehicle exhaust, indoor sources include kerosene or wood burning stoves.	Headaches, reduced mental alertness, heart attack, cardiovascular diseases, impaired fetal development, death.	Contribute to the formation of smog.
Sulfur Dioxide (SO_2)	Colorless gas that dissolves in water vapor to form acid, and interact with other gases and particles in the air.	Coal-fired power plants, petroleum refineries, manufacture of sulfuric acid and smelting of ores containing sulfur.	Eye irritation, wheezing, chest tightness, shortness of breath, lung damage.	Contribute to the formation of acid rain, visibility impairment, plant and water damage, aesthetic damage.
Nitrogen Dioxide (NO_2)	Reddish brown, highly reactive gas.	Motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels.	Susceptibility to respiratory infections, irritation of the lung and respiratory symptoms (e.g., cough, chest pain, difficulty breathing).	Contribute to the formation of smog, acid rain, water quality deterioration, global warming, and visibility impairment.
Ozone (O_3)	Gaseous pollutant when it is formed in the troposphere.	Vehicle exhaust and certain other fumes. Formed from other air pollutants in the presence of sunlight.	Eye and throat irritation, coughing, respiratory tract problems, asthma, lung damage.	Plant and ecosystem damage.
Lead (Pb)	Metallic element	Metal refineries, lead smelters, battery manufacturers, iron and steel producers.	Anemia, high blood pressure, brain and kidney damage, neurological disorders, cancer, lowered IQ.	Affects animals and plants, affects aquatic ecosystems.
Particulate Matter (PM)	Very small particles of soot, dust, or other matter, including tiny droplets of liquids.	Diesel engines, power plants, industries, windblown dust, wood stoves.	Eye irritation, asthma, bronchitis, lung damage, cancer, heavy metal poisoning, cardiovascular effects.	Visibility impairment, atmospheric deposition, aesthetic damage.

Acid Rain

One way in which SO2 is removed from the atmosphere is the formation of acid rain

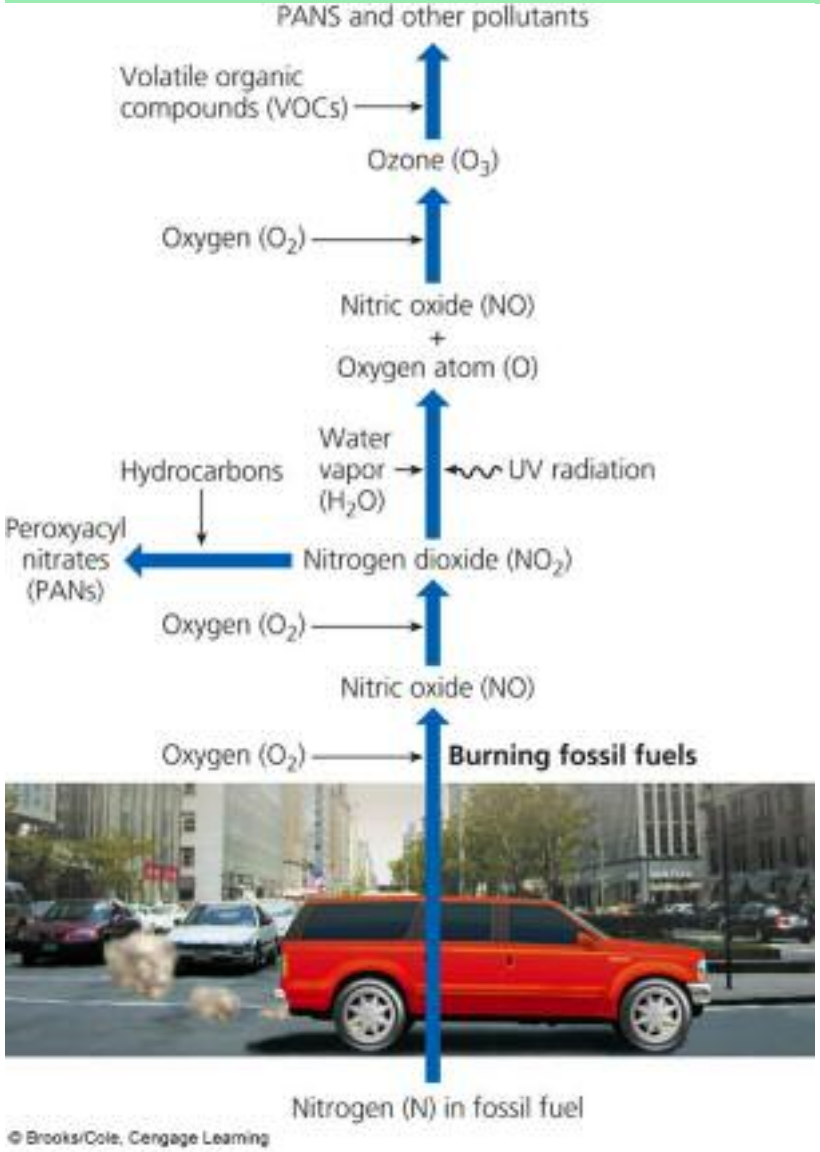
- contains high levels of sulfuric or nitric acids
- contaminate drinking water and vegetation
- damage aquatic life
- erode buildings
- Alters the chemical equilibrium of some soils

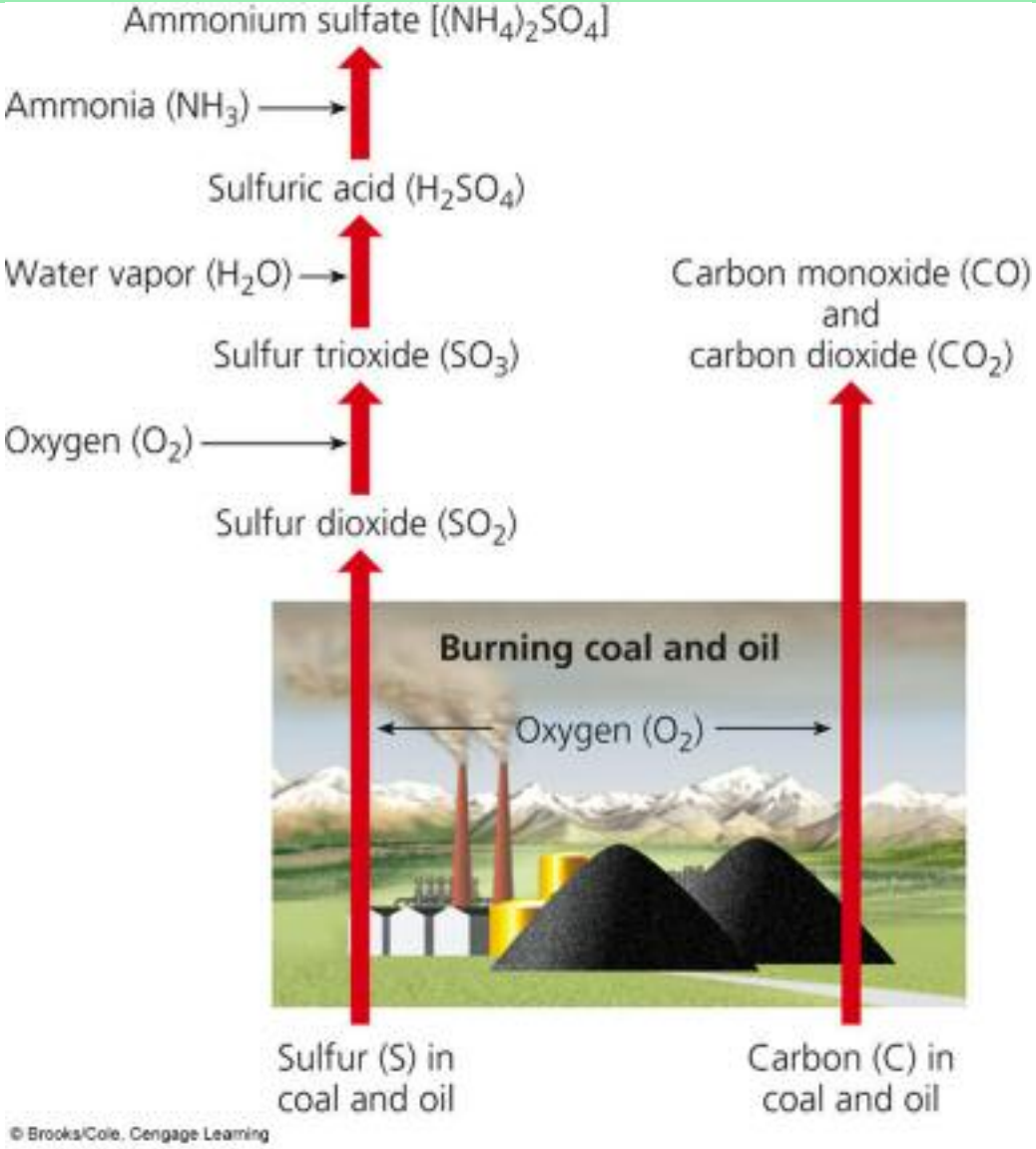
$$N_2 + O_2 \longrightarrow 2NO$$
$$NO + O_3 \longrightarrow NO_2 + O_2$$
$$NO_2 + O_3 + H_2O \longrightarrow 2HNO_3 + O_2$$



$$S + O_2 \xrightarrow{\text{heat}} SO_2$$
$$SO_2 + O \xrightarrow{\text{sunlight}} SO_3$$
$$SO_3 + H_2O \longrightarrow H_2SO_4$$

Photochemical Smog



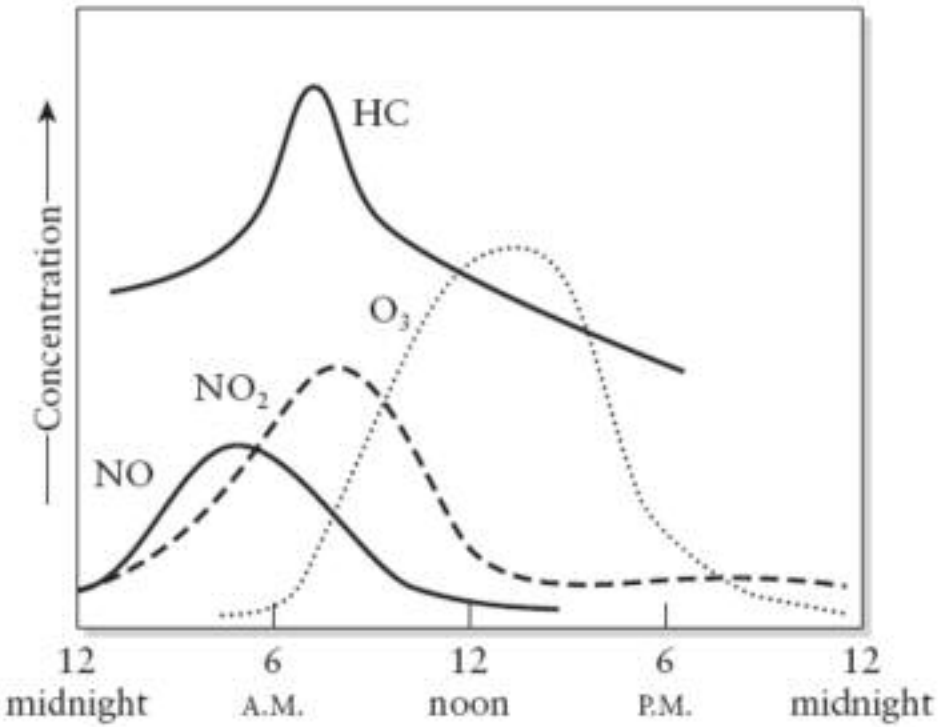


Simplified Reaction Scheme

Hydrocarbons + Nox + Sunlight → photochemical smog (oxidants)

- primary oxidants produced: ozone (O_3), formaldehyde, peroxyacetyl nitrate (PAN)

NO_2 + Light	→	NO + O
O + O_2	→	O_3
O_3 + NO	→	NO_2 + O_2
O + HC	→	HCO°
HCO° + O_2	→	HCO_3°
HCO_3° + HC	→	Aldehydes, ketones, etc.
HCO_3° + NO	→	HCO_2° + NO_2
HCO_3° + O_2	→	O_3 + HCO_2°
HCO_x° + NO_2	→	Peroxyacetyl nitrates



Photochemical Smog in Santiago, Chile

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Ozone Depletion

- Ozone (O_3) is an eye irritant at usual urban levels, but urban O_3 should not be confused with stratospheric O_3, 7 to 10 mi above the earth's surface.
- The latter acts as an ultraviolet radiation shield, and its alteration can increase the risk of skin cancer as well as change the ecology in unpredictable ways.

Ozone in the upper atmosphere is created when oxygen reacts with light energy ($h\nu$):

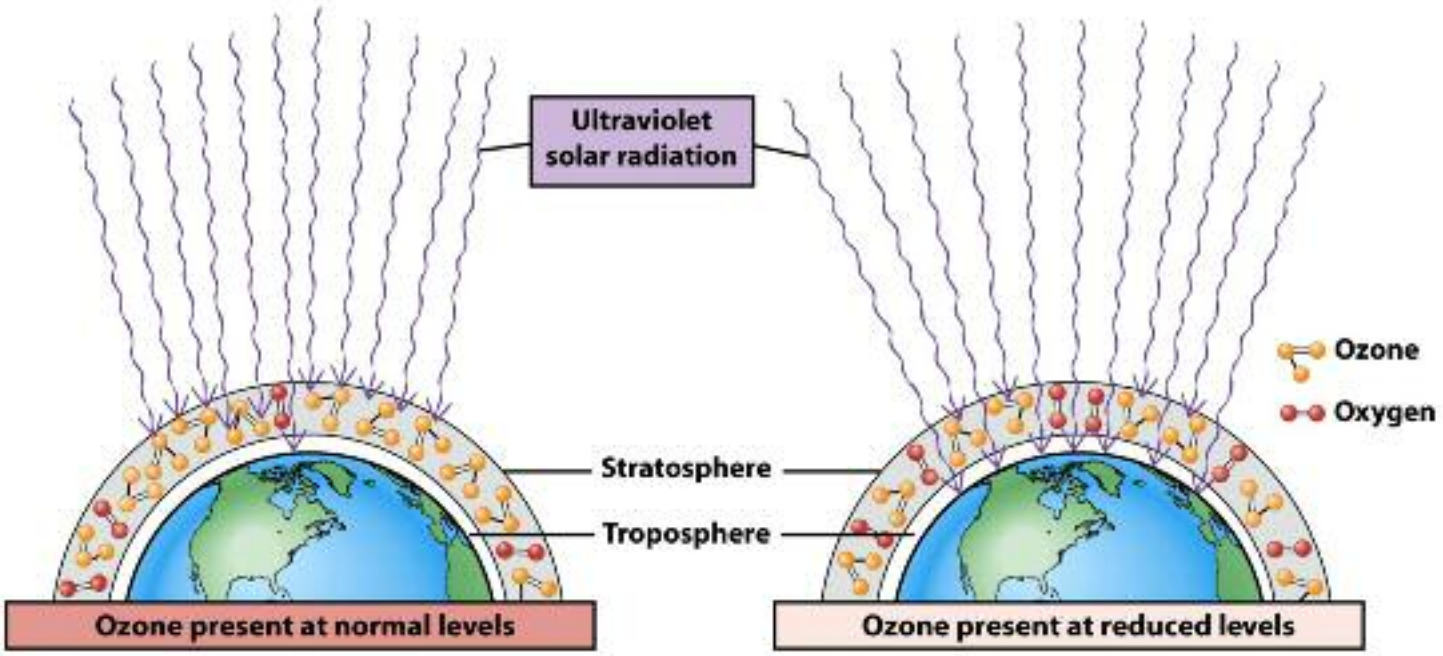
$$O_2 + h\nu \longrightarrow O + O$$
$$O_2 + O \longrightarrow O_3$$

Light energy also destroys ozone:

$$O_3 + h\nu \longrightarrow O_2 + O$$

This is the mechanism by which ozone prevents ultraviolet radiation from reaching earth's surface.

- ✓ Ozone Protects earth from UV radiation Part of the electromagnetic spectrum with wavelengths just shorter than visible light



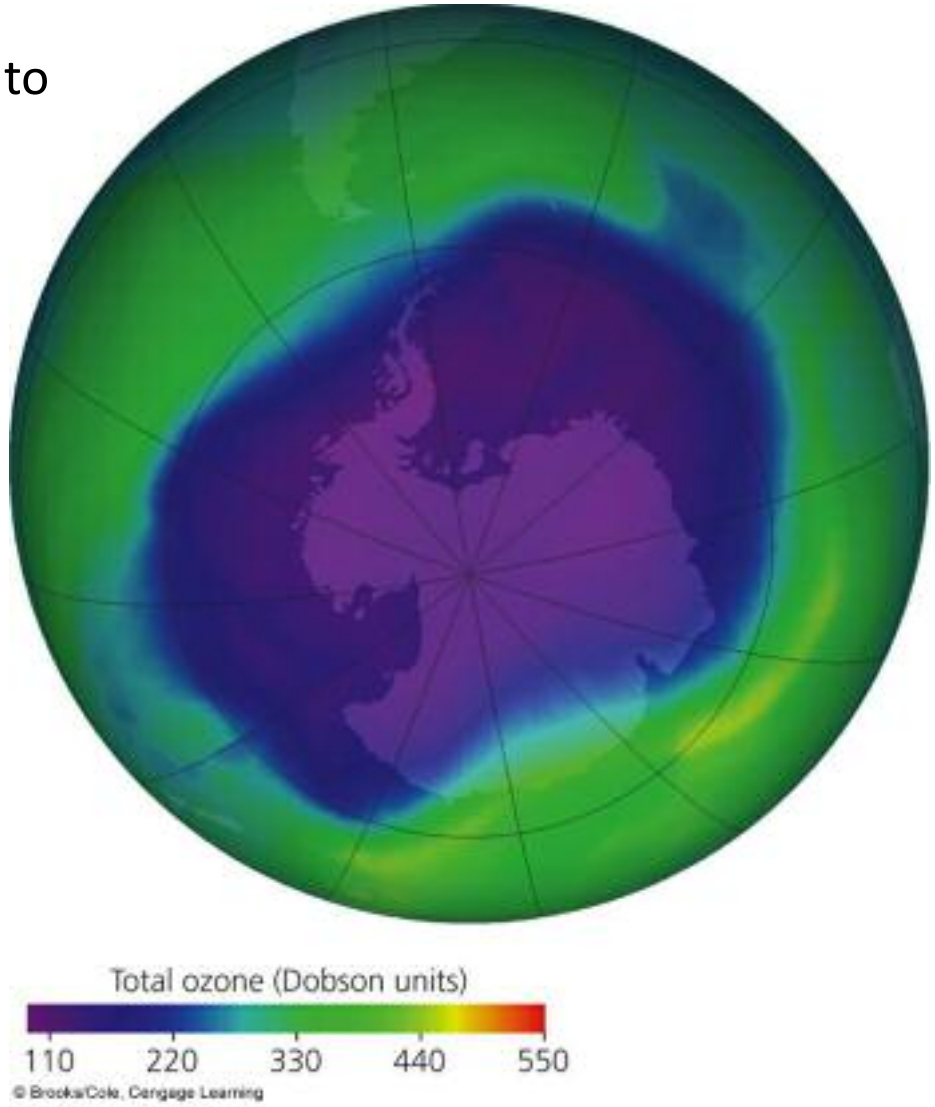
(a) Stratospheric ozone absorbs about 99% of incoming solar ultraviolet (UV) radiation, effectively shielding the surface.

(b) When stratospheric ozone is present at reduced levels, more high-energy UV radiation penetrates the atmosphere to the surface, where its presence harms organisms.

Dobson units **(*DU*)** were developed to measure ozone concentration:

1 DU= 0.01 mm of O_3 at 1 atm and 0◦C

At midlatitudes the ozone concentration is typically about 350 DU, at the equator it is 250 DU, and in the Antarctic region it is only 100 DU.

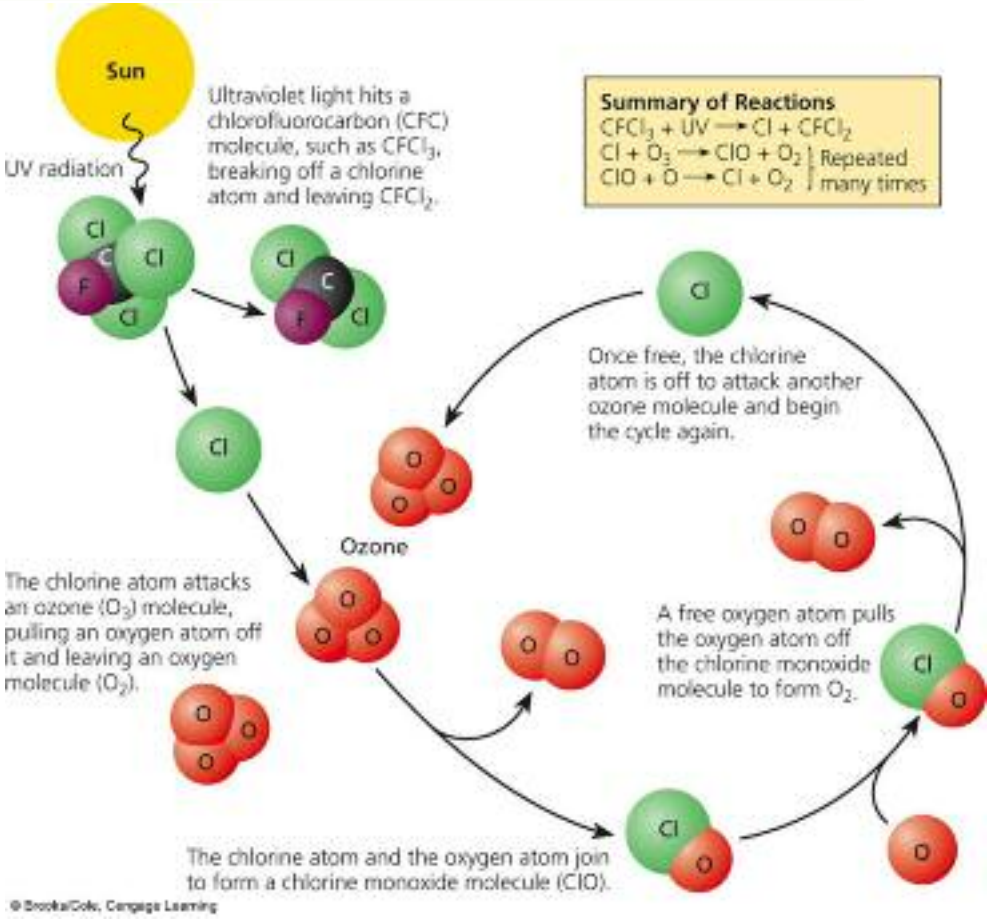


How O_3 is Depleted in the Stratosphere?

- Widespread use of certain chemicals has reduced ozone levels in the stratosphere, which allows for more harmful ultraviolet radiation to reach the earth's surface

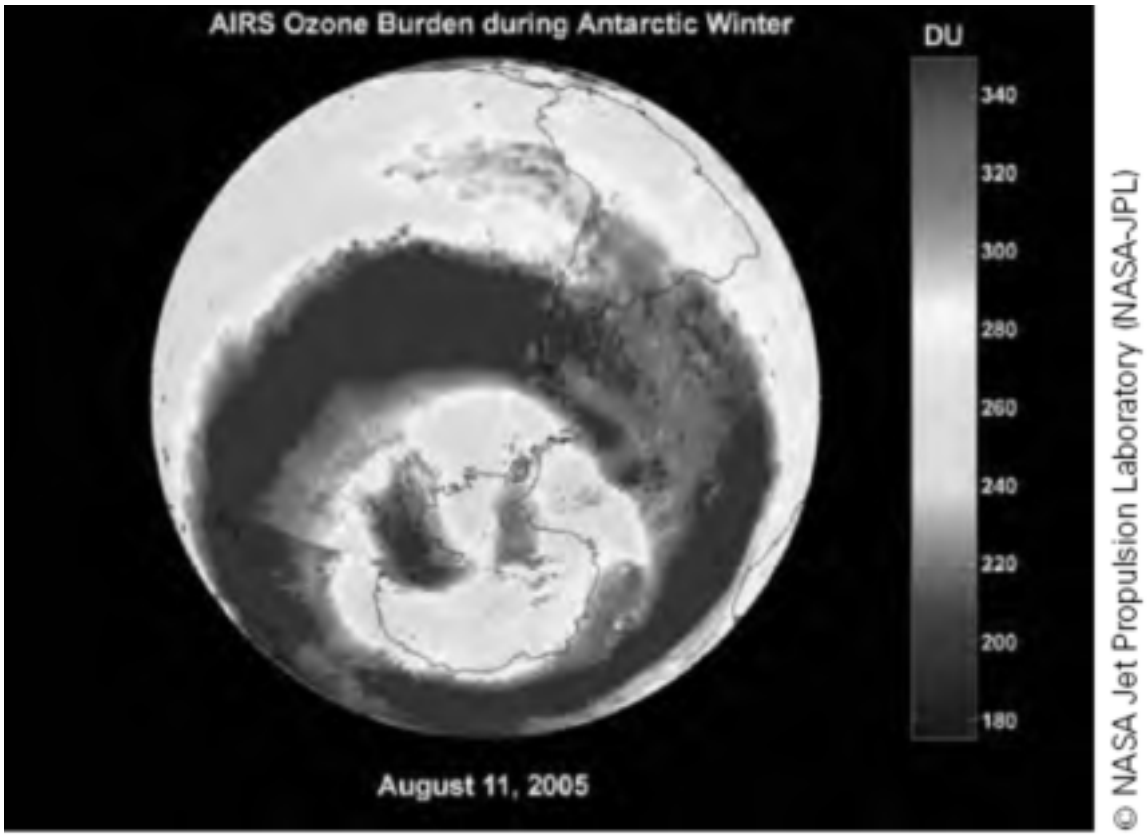
- The chlorofluorocarbons (CFCs). chemicals that found wide use in aerosols and refrigeration systems and are responsible for climate change as well as the depletion of the protective ozone layer in the stratosphere.

Two of the most important CFCs are trichlorofluoromethane, CFCl3, and dichlorodifluoromethane, CF2Cl2, both of which are inert and not water soluble and, therefore, do not wash out of the atmosphere.



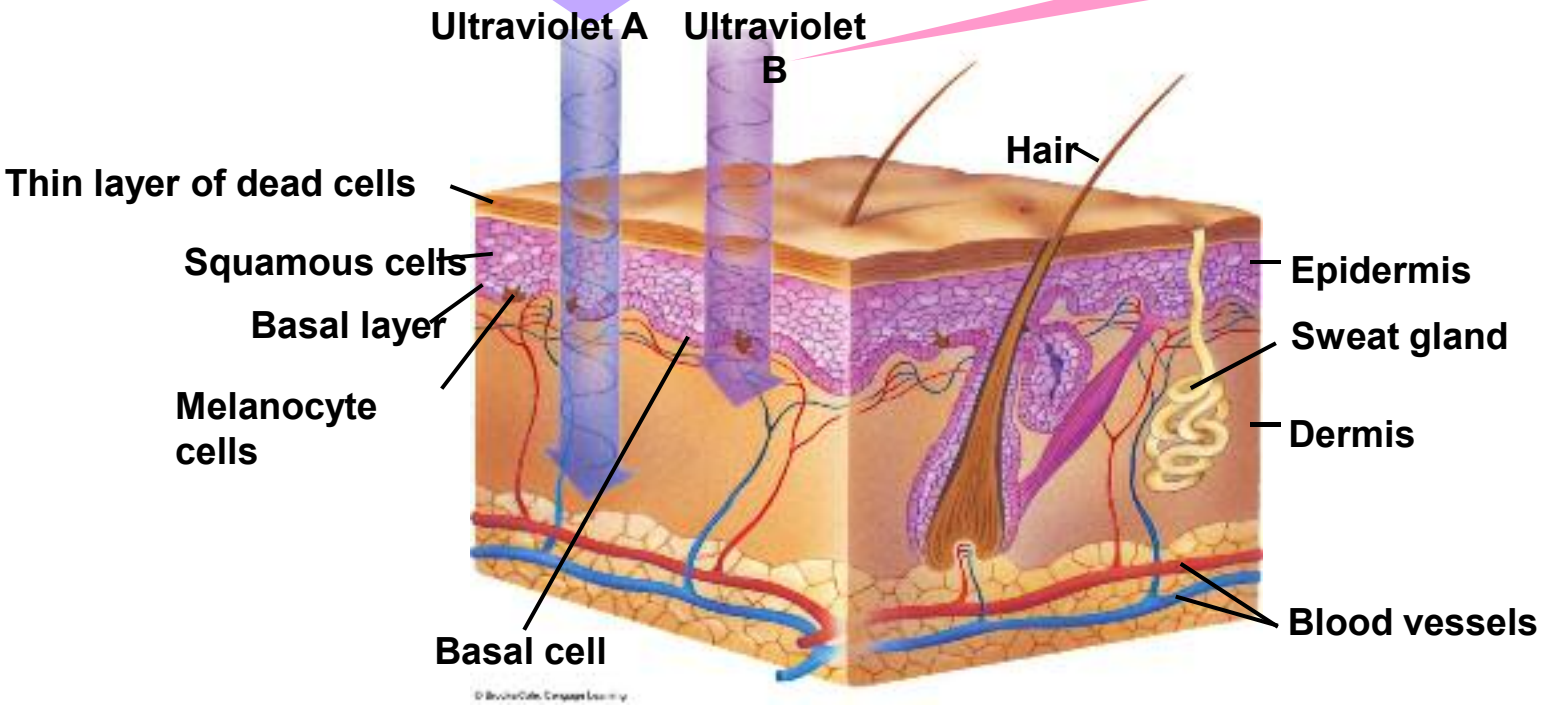
The ozone hole & risks

There indeed was a huge monster hole right in the middle of the South Pole.



This long-wavelength (low-energy) form of UV radiation causes aging of the skin, tanning, and sometimes sunburn. It penetrates deeply and may contribute to skin cancer.

This shorter-wavelength (high-energy) form of UV radiation causes sunburn, premature aging, and wrinkling. It is largely responsible for basal and squamous cell carcinomas and plays a role in malignant melanoma.



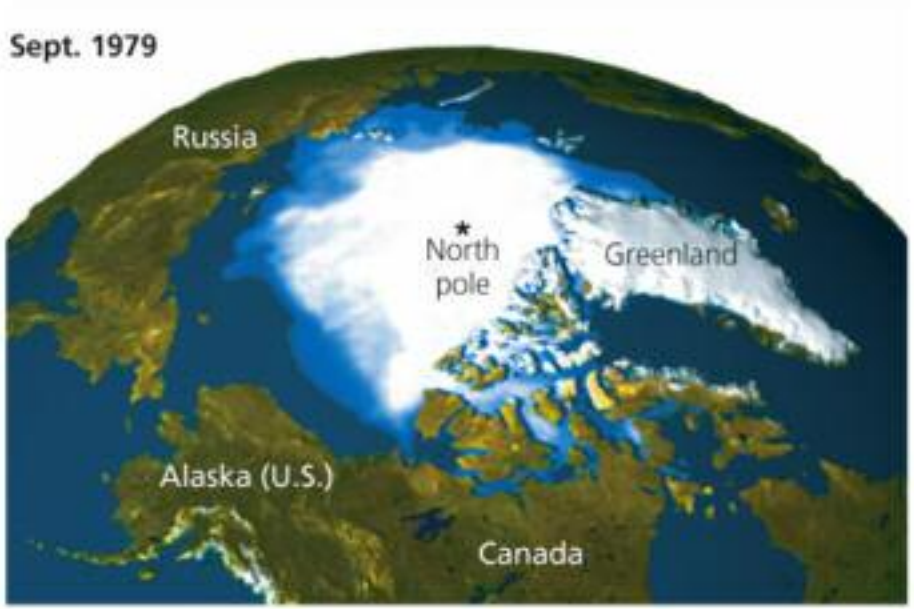
Squamous Cell Carcinoma

Basal Cell Carcinoma

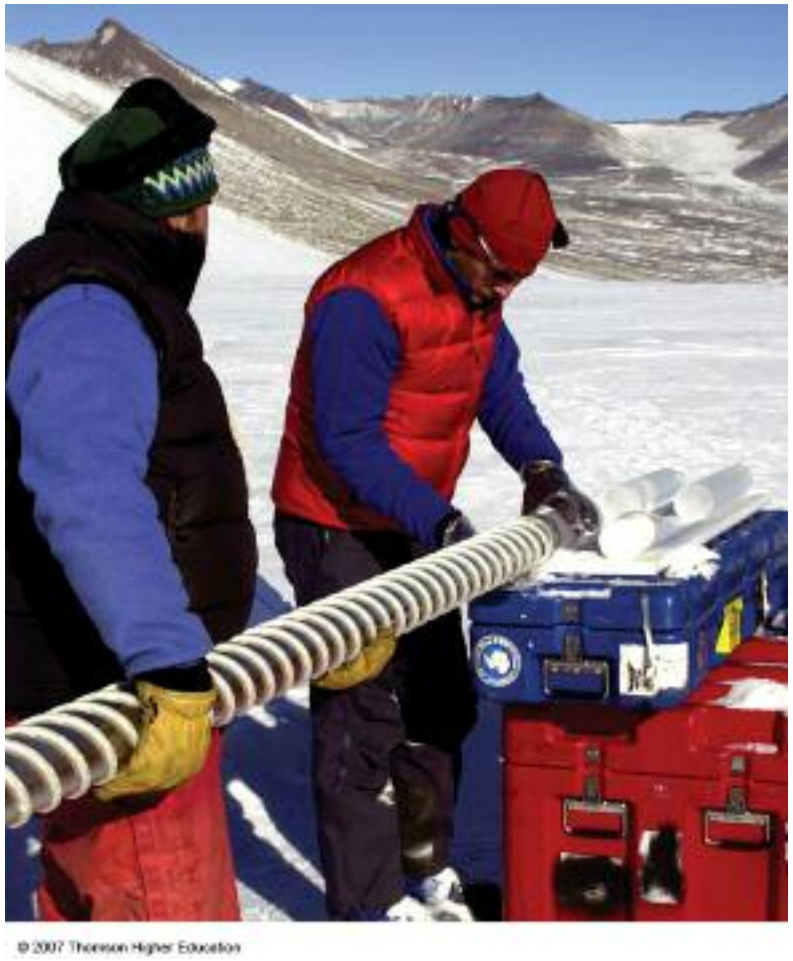
Melanoma

Climate Change

- The overwhelming scientific consensus is that the earth's atmosphere is warming rapidly, mostly because of human activities, and that this will lead to significant climate change during this century.



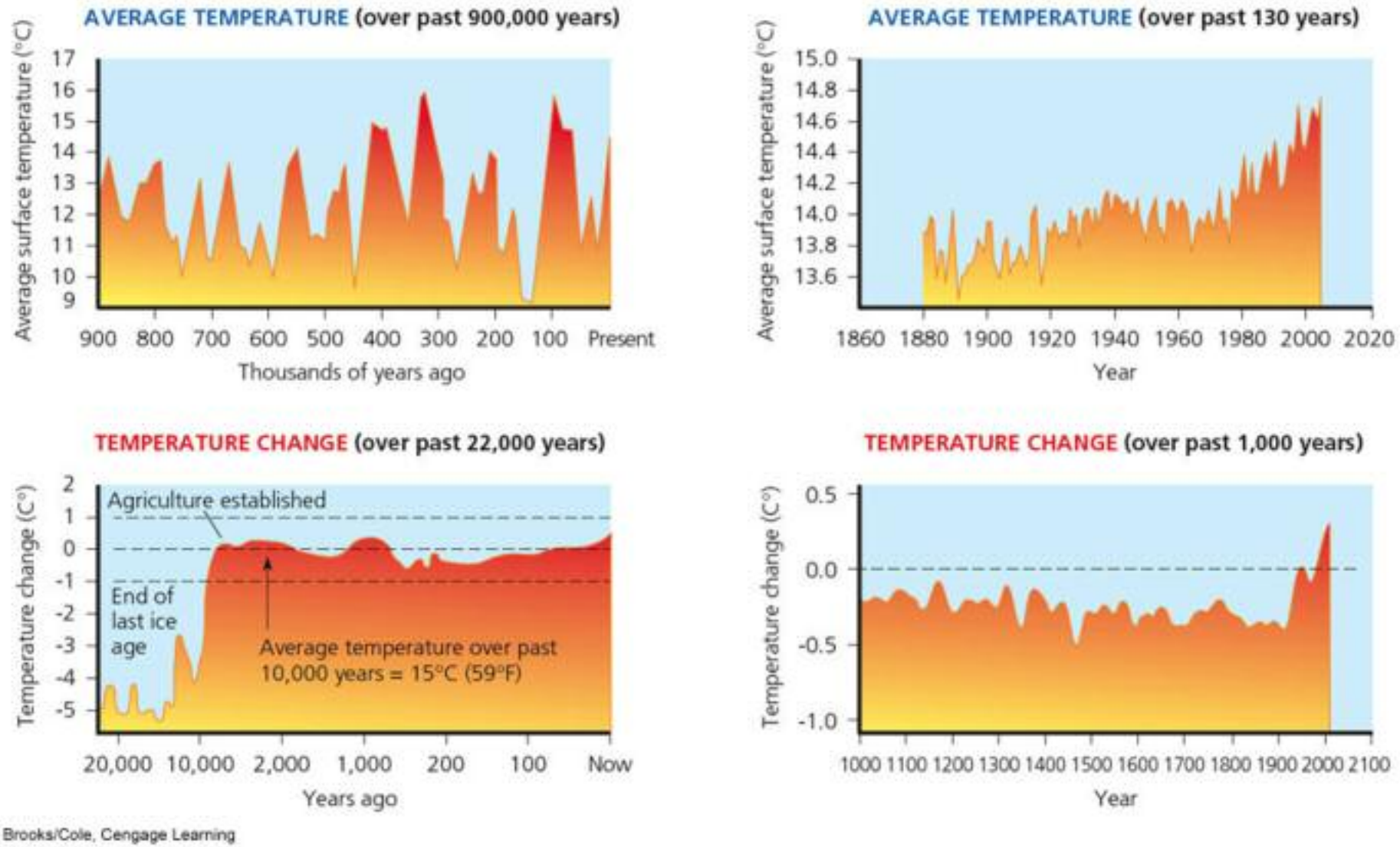
Temperatures in the Past ?



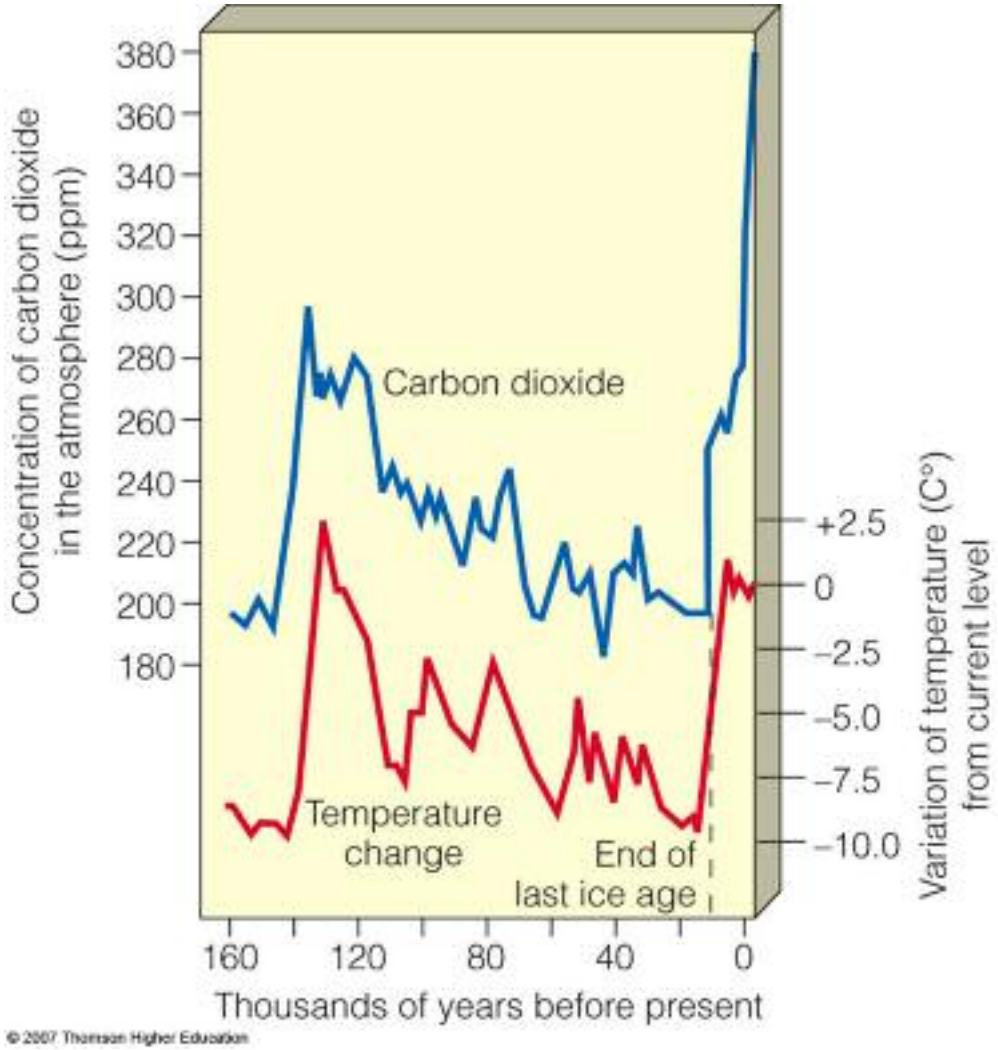
Scientists analyze tiny air bubbles trapped in ice cores learn about past:

- troposphere composition.
- temperature trends.
- greenhouse gas concentrations.
- solar, snowfall, and forest fire activity.

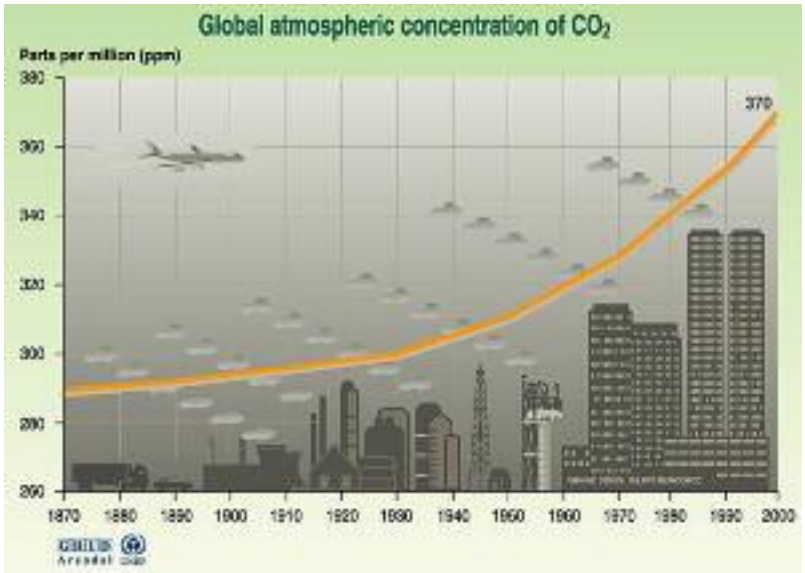
Estimated Changes



Carbon Dioxide at highest levels



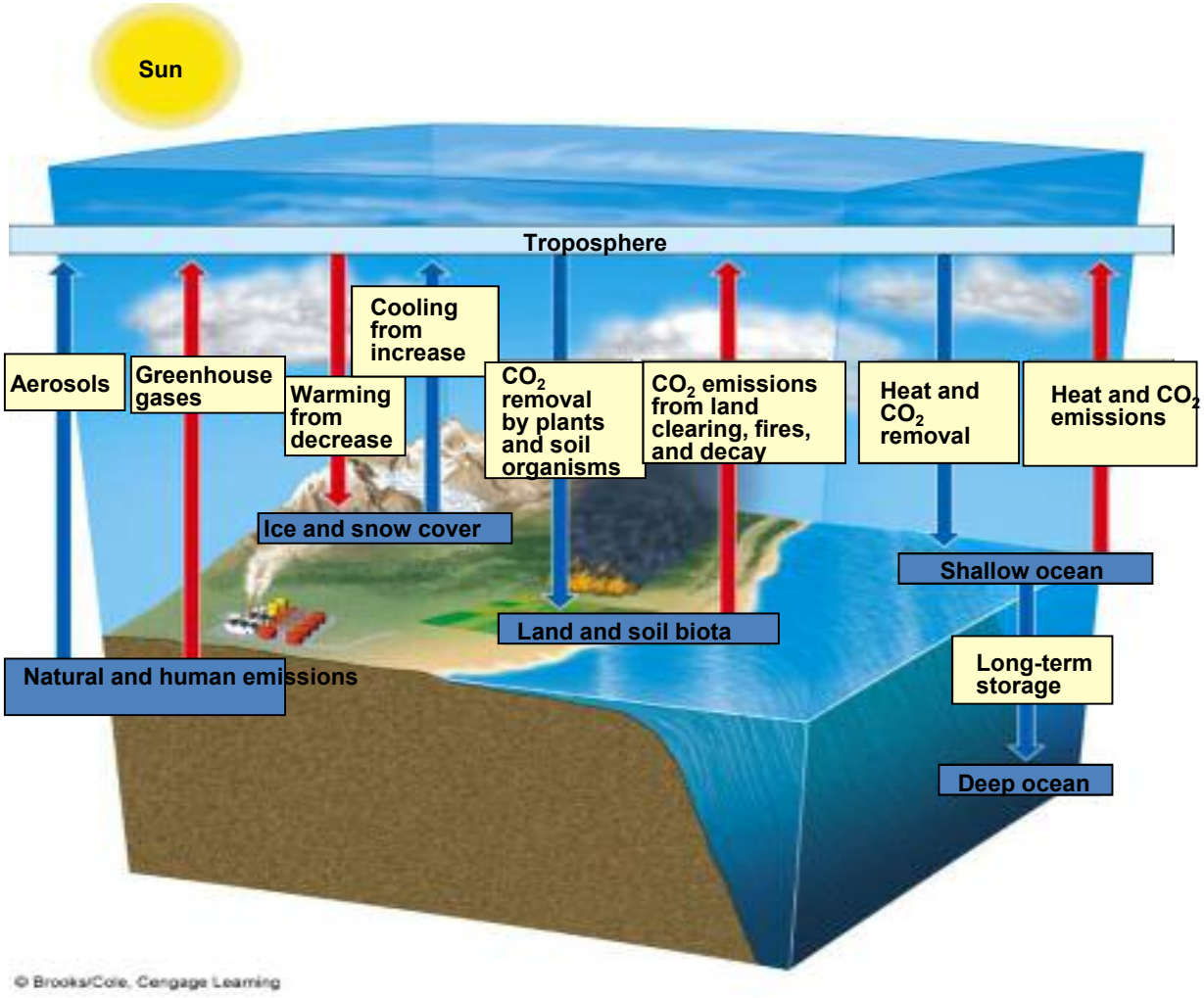
In 2005, an ice core showed that CO_2 levels in the troposphere are the highest they have been in 650,000 years.



Climate Change Consequences

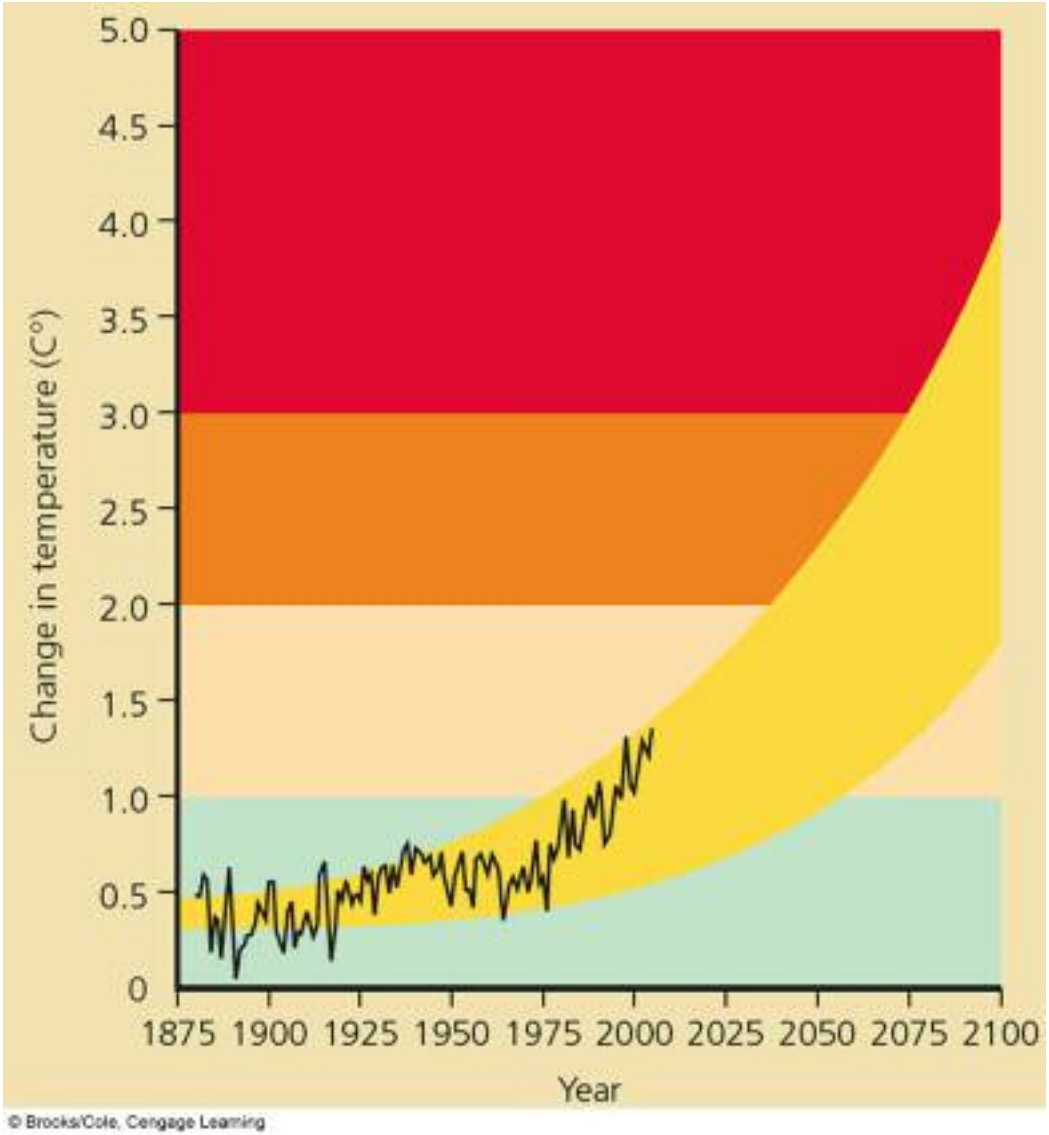
- 90–99% likely that lower atmosphere is warming
- 1906–2005: Ave. temp increased about 0.74˚C
- 1970–2005: Annual greenhouse emissions up 70%
- Past 50 years: Arctic temp rising almost twice as fast as the rest of the earth
- Melting of glaciers and floating sea ice
- Prolonged droughts: increasing
- Last 100 years: sea levels rose 10–20 cm
- Warmer temperatures in Alaska, Russia, and the Arctic are melting permafrost releasing more CO_2 and CH_4 into the troposphere.

Greenhouse Gases Effect

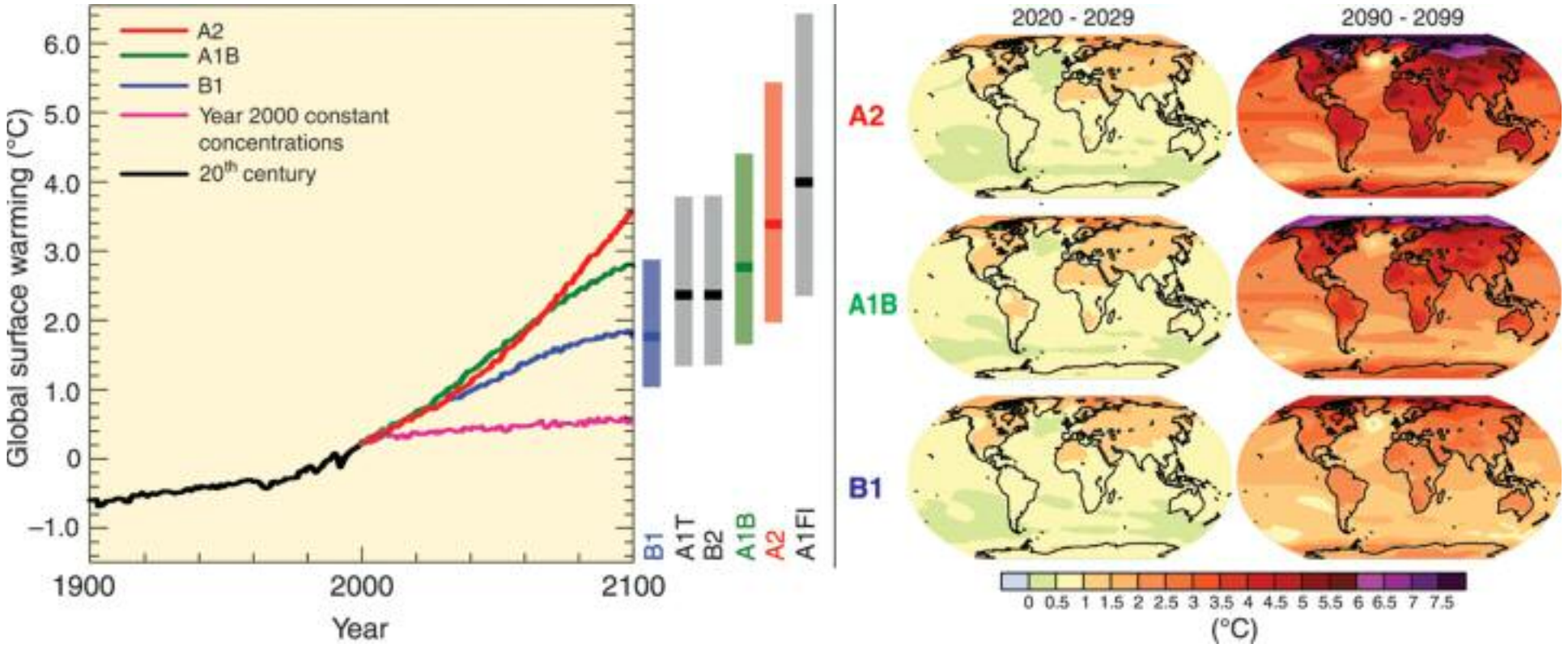


Measured Temperature and Projected Changes

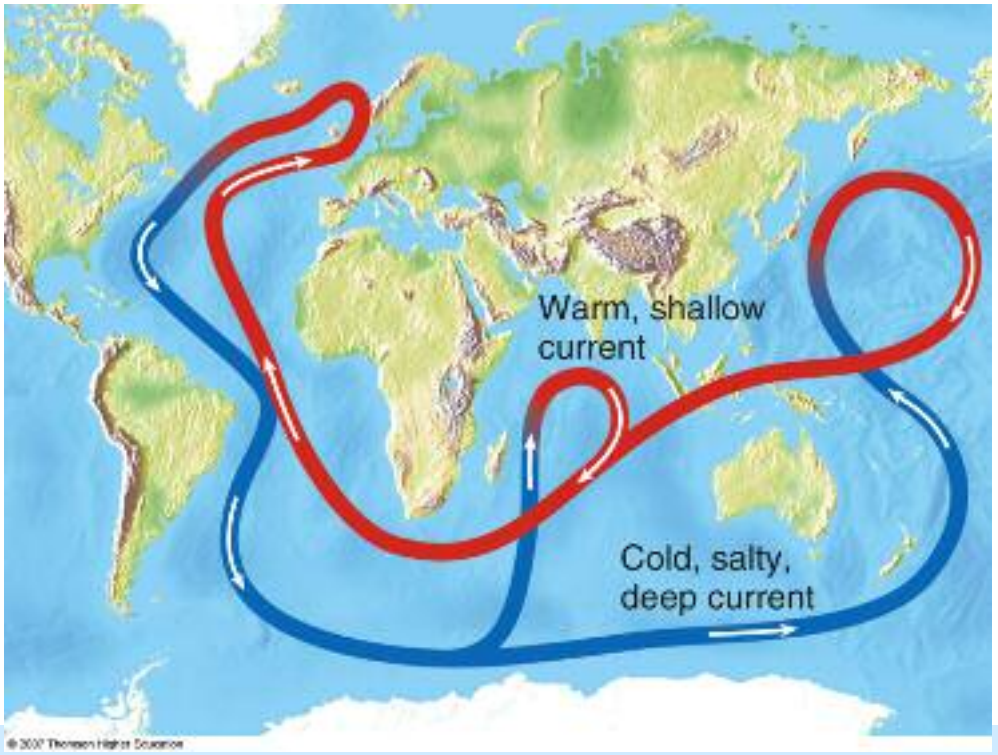
- The projected rapid change in the atmosphere's temperature during this century is very likely to increase drought and flooding, shift areas where food can be grown, raise sea levels, result in intense heat waves, and cause the premature extinction of many species.

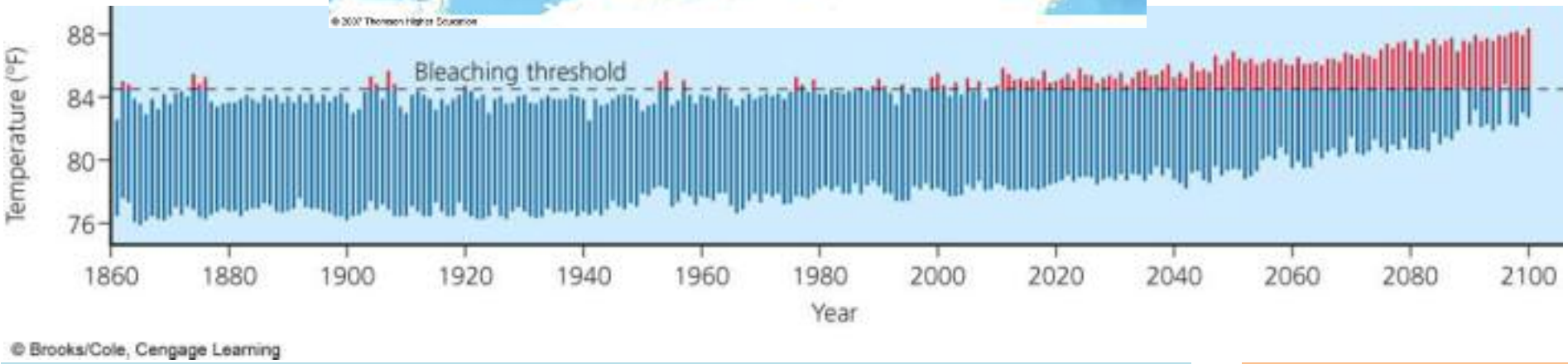


Temperature projections



Changing Ocean Currents





Glacial Ice Melting & Decline in Arctic Tundra

CC Regional Impacts

North America	• Warming in western mountains is projected to cause decreased snowpack, more winter flooding and reduced summer flows, exacerbating competition for over-allocated water resources. • In the early decades of the century, moderate climate change is projected to increase aggregate yields of rain-fed agriculture by 5 to 20%, but with important variability among regions. Major challenges are projected for crops that are near the warm end of their suitable range or which depend on highly utilised water resources. • Cities that currently experience heat waves are expected to be further challenged by an increased number, intensity and duration of heat waves during the course of the century, with potential for adverse health impacts. • Coastal communities and habitats will be increasingly stressed by climate change impacts interacting with development and pollution.
Polar Regions	• The main projected biophysical effects are reductions in thickness and extent of glaciers, ice sheets and sea ice, and changes in natural ecosystems with detrimental effects on many organisms including migratory birds, mammals and higher predators. • For human communities in the Arctic, impacts, particularly those resulting from changing snow and ice conditions, are projected to be mixed. • Detrimental impacts would include those on infrastructure and traditional indigenous ways of life. • In both polar regions, specific ecosystems and habitats are projected to be vulnerable, as climatic barriers to species invasions are lowered.
Small Islands	• Sea level rise is expected to exacerbate inundation, storm surge, erosion and other coastal hazards, thus threatening vital infrastructure, settlements and facilities that support the livelihood of island communities. • Deterioration in coastal conditions, for example through erosion of beaches and coral bleaching, is expected to affect local resources. • By mid-century, climate change is expected to reduce water resources in many small islands, e.g. in the Caribbean and Pacific, to the point where they become insufficient to meet demand during low-rainfall periods. • With higher temperatures, increased invasion by non-native species is expected to occur, particularly on mid- and high-latitude islands.

CC Impacts

Very likely = 90% probable

Table SPM.3. Examples of possible impacts of climate change due to changes in extreme weather and climate events, based on projections to the mid- to late 21st century. These do not take into account any changes or developments in adaptive capacity. The likelihood estimates in column two relate to the phenomena listed in column one. {Table 3.2}

Phenomenon[a] and direction of trend	Likelihood of future trends based on projections for 21st century using SRES scenarios	Examples of major projected impacts by sector			
		Agriculture, forestry and ecosystems	Water resources	Human health	Industry, settlement and society
Over most land areas, warmer and fewer cold days and nights, warmer and more frequent hot days and nights	*Virtually certain*[b]	Increased yields in colder environments; decreased yields in warmer environments; increased insect outbreaks	Effects on water resources relying on snowmelt; effects on some water supplies	Reduced human mortality from decreased cold exposure	Reduced energy demand for heating; increased demand for cooling; declining air quality in cities; reduced disruption to transport due to snow, ice; effects on winter tourism
Warm spells/heat waves. Frequency increases over most land areas	*Very likely*	Reduced yields in warmer regions due to heat stress; increased danger of wildfire	Increased water demand; water quality problems, e.g. algal blooms	Increased risk of heat-related mortality, especially for the elderly, chronically sick, very young and socially isolated	Reduction in quality of life for people in warm areas without appropriate housing; impacts on the elderly, very young and poor
Heavy precipitation events. Frequency increases over most areas	*Very likely*	Damage to crops; soil erosion, inability to cultivate land due to waterlogging of soils	Adverse effects on quality of surface and groundwater; contamination of water supply; water scarcity may be relieved	Increased risk of deaths, injuries and infectious, respiratory and skin diseases	Disruption of settlements, commerce, transport and societies due to flooding; pressures on urban and rural infrastructures; loss of property

Projected CC Impacts

2°C (3.6°F) Warming with 450 ppm CO_2 (now unavoidable effects)

- Forest fires worsen
- Prolonged droughts intensify
- Deserts spread
- Major heat waves more common
- Fewer winter deaths in higher latitudes
- Conflicts over water supplies increase
- Modest increases in crop production in temperate regions
- Crop yields fall by 5–10% in tropical Africa
- Coral reefs affected by bleaching
- Many glaciers melt faster and threaten water supplies for up to 100 million people
- Sea levels rise enough to flood low-lying coastal areas such as Bangladesh
- More people exposed to malaria
- High risk of extinction for Arctic species such as the polar bear

3°C (5.4°F) Warming with 550 ppm CO_2 (potentially avoidable effects)

- Forest fires get much worse
- Prolonged droughts get much worse
- Deserts spread more
- Major heat waves and deaths from heat increase
- Irrigation and hydropower decline
- 1.4 billion people suffer water shortages
- Water wars, environmental refugees, and terrorism increase
- Malaria and several other tropical diseases spread faster and further
- Crop pests multiply and spread
- Crop yields fall sharply in many areas, especially Africa
- Coral reefs severely threatened
- Amazon rainforest may begin collapsing
- Up to half of Arctic tundra melts
- Sea levels continue to rise
- 20–30% of plant and animal species face premature extinction

4°C (7.2°F) Warming with 650 ppm CO_2 (potentially avoidable effects)

- Forest fires and drought increase sharply
- Water shortages affect almost all people
- Crop yields fall sharply in all regions and cease in some regions
- Tropical diseases spread even faster and further
- Water wars, environmental refugees, terrorism, and economic collapse increase sharply
- Methane emissions from melting permafrost accelerate
- Ecosystems such as coral reefs, tropical forests, alpine and Arctic tundra, polar seas, coastal wetlands, and high-elevation mountaintops begin collapsing
- Glaciers and ice sheets melt faster
- Sea levels rise faster and flood many low-lying cities and agricultural areas
- At least half of plant and animal species face premature extinction

Air Pollution Standards

National Ambient Air Quality Standards (NAAQS)

Criteria Pollutant	Standard Type	Concentration ($\mu g \cdot m^{-3}$)	Concentration (ppm)	Averaging Period or Method	Allowable Exceedances[a]
CO	Primary	10,000	9	8-hour average	Once per year
	Primary	40,000	35	1-hour average	Once per year
Lead	Primary and secondary	1.5		Maximum arithmetic mean measured over a calendar quarter	
NO_2	Primary and secondary	100	0.053	Annual arithmetic mean	
Ozone	Primary and secondary	235	0.12	Maximum hourly average	Once per year
Ozone[b]	Primary and secondary	157	0.08	8-h average	[c]
Particulate matter (PM_{10})[d]	Primary and secondary	150		24-h average	One day per year
	Primary and secondary	50		Annual arithmetic mean	
($PM_{2.5}$)[b]	Primary and secondary	65		24-h average	One day per year
		15		Annual arithmetic mean	
SO_2	Primary	80	0.03	Annual arithmetic mean	
	Primary	365	0.14	Maximum 24-h concentration	Once per year
SO_2	Secondary	1300	0.5	Maximum 3-h concentration	Once per year

Air Pollution Standards

TABLE 6-1
National ambient air quality standards

Pollutant	Averaging time	Primary standard
Carbon monoxide	8 h	10,000 $\mu g/m^3$ (9 ppm)
	1 h	40,000 $\mu g/m^3$ (35 ppm)
Hydrocarbons[a]	3 h	160 $\mu g/m^3$ (0.24 ppm)
Lead	Monthly avg.	1.5 $\mu g/m^3$
Nitrogen dioxide	Annual avg.	100 $\mu g/m^3$ (0.05 ppm)
	1 h	500 $\mu g/m^3$ (0.25 ppm)
Photochemical oxidants[b]	1 h	240 $\mu g/m^3$ (0.12 ppm)
Sulfur dioxide	Annual avg.	80 $\mu g/m^3$ (0.03 ppm)
	24 h	365 $\mu g/m^3$ (0.14 ppm)
Total suspended particulates	Annual geometric mean	75 $\mu g/m^3$
	24 h	260 $\mu g/m^3$

[a] Corrected for CH_4.

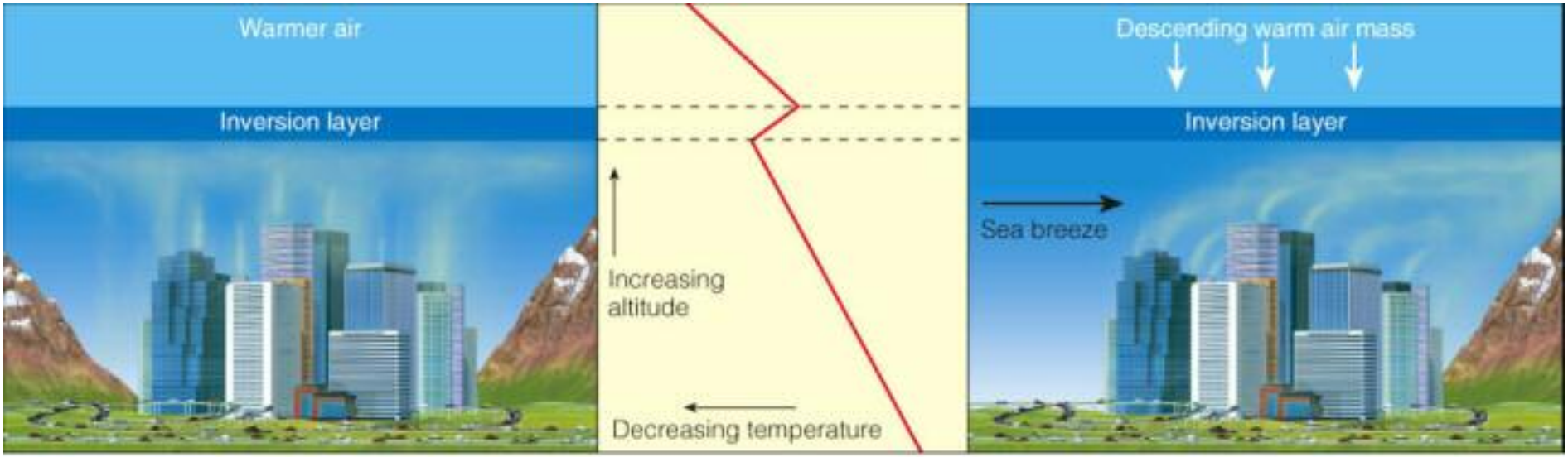
[b] Corrected for SO_2 and NO_2.

Outdoor Air Pollution

Several Factors Can Decrease or Increase Outdoor Air Pollution:

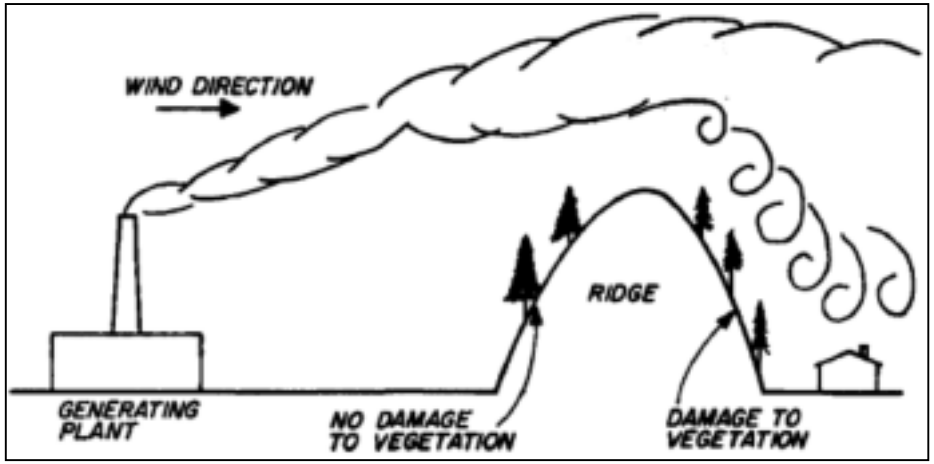
- Outdoor air pollution may be decreased by:
  - ✓ Settling of particles due to gravity
  - ✓ Rain and snow
  - ✓ Salty sea spray from the ocean
  - ✓ Winds
  - ✓ Chemical reactions
- Outdoor air pollution may be increased by:
  - ✓ Urban buildings
  - ✓ Hills and mountains
  - ✓ High temperatures
  - ✓ Emissions of VOCs from certain trees and plants
  - ✓ Temperature inversions

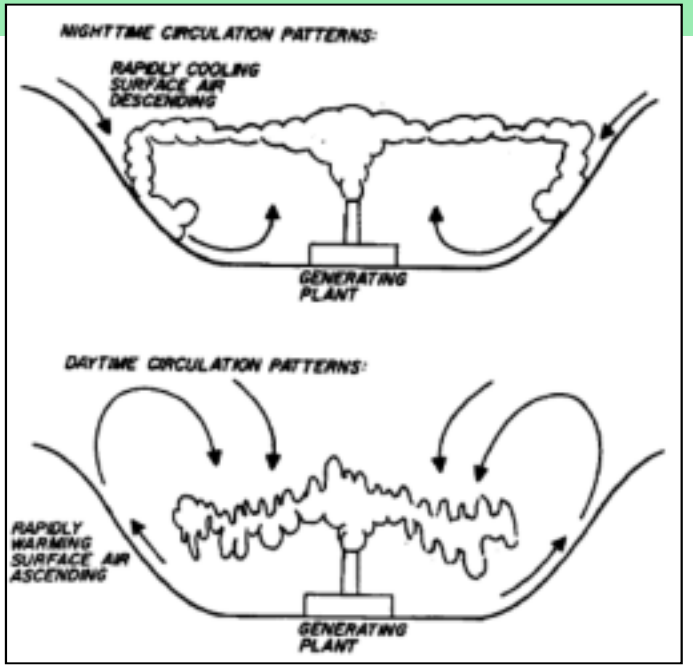
Temperature Inversions

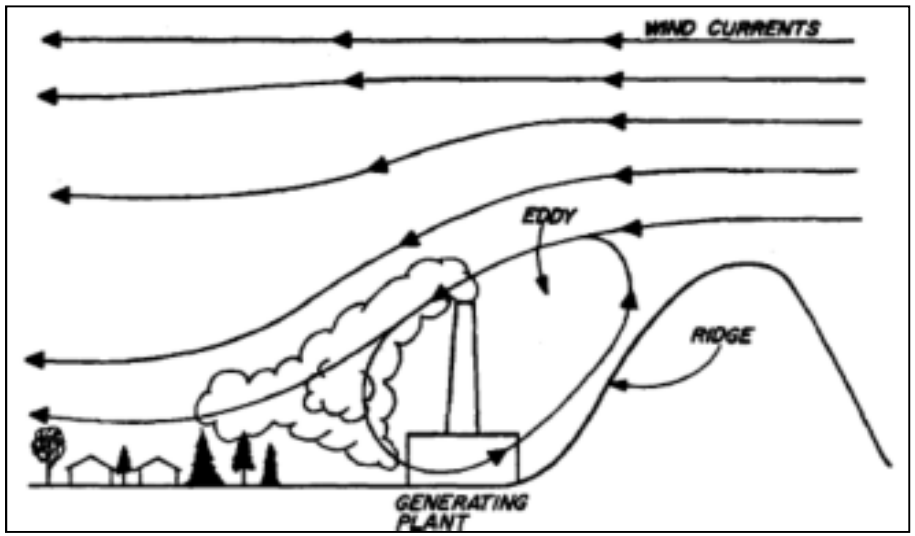


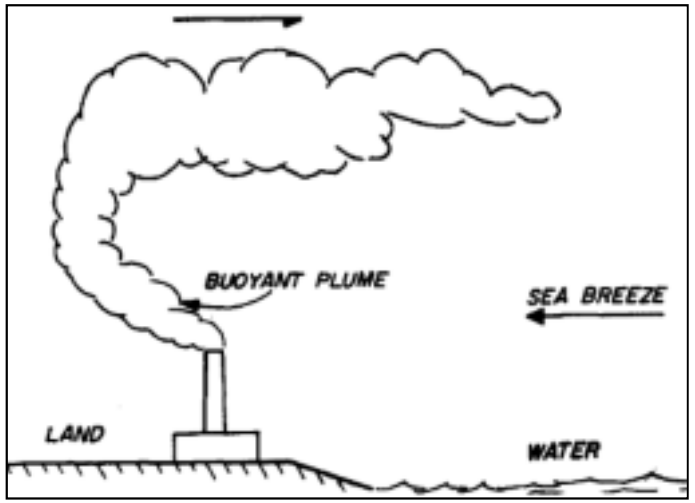
- Cold, cloudy weather in a valley surrounded by mountains can trap air pollutants (left).

- Areas with sunny climate, light winds, mountains on three sides and an ocean on the other (right) are susceptible to inversions.


WIND DIRECTION
RIDGE
GENERATING PLANT
NO DAMAGE TO VEGETATION
DAMAGE TO VEGETATION


NIGHTTIME CIRCULATION PATTERNS:
RAPIDLY COOLING SURFACE AIR DESCENDING
GENERATING PLANT
DAYTIME CIRCULATION PATTERNS:
RAPIDLY WARMING SURFACE AIR ASCENDING
GENERATING PLANT


WIND CURRENTS
EDDY
RIDGE
GENERATING PLANT


BUOYANT PLUME
SEA BREEZE
LAND
WATER

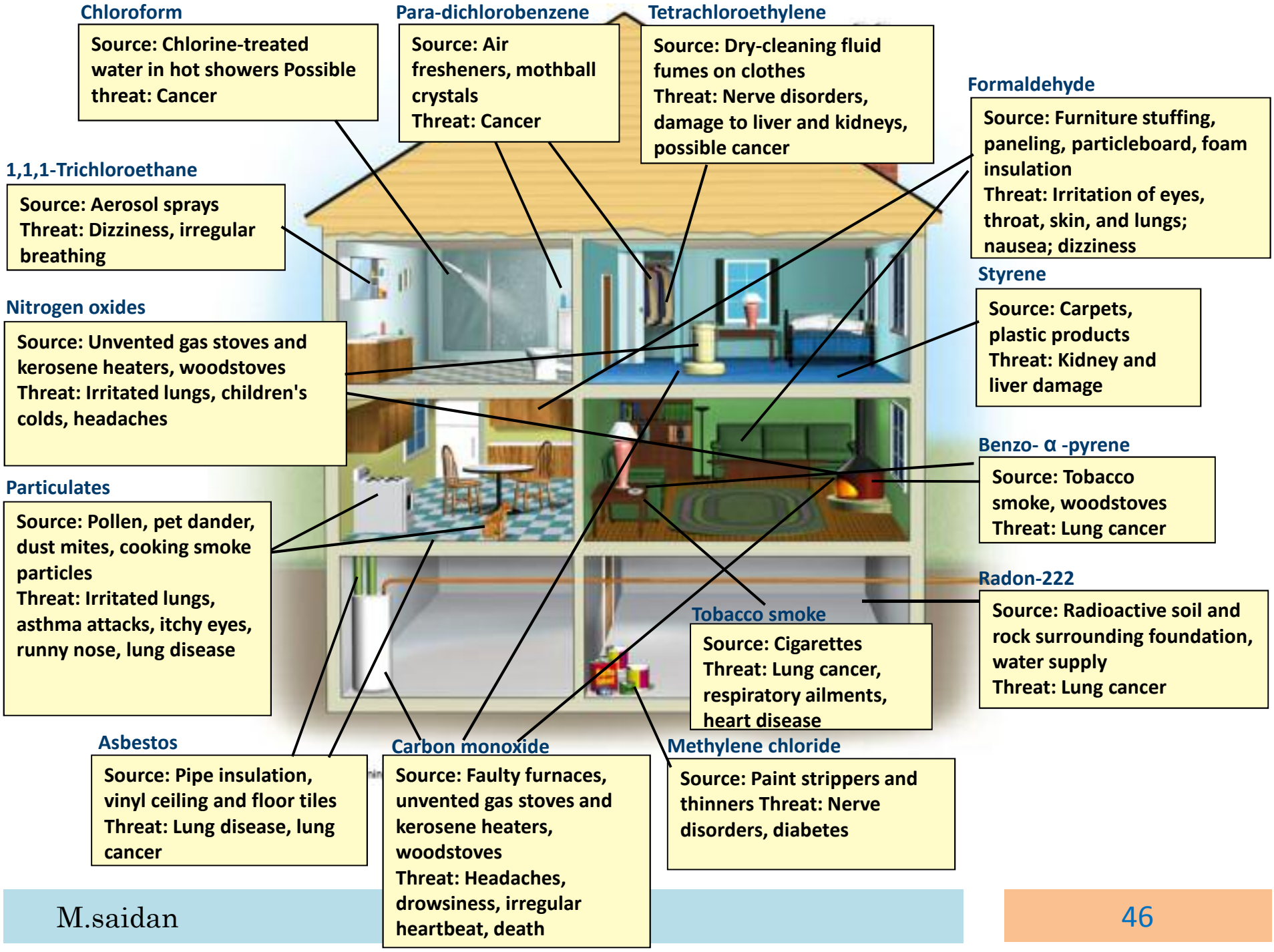
Indoor Air Pollution

- Who are at greatest risk from indoor air pollution?

  - Children under 5 and the elderly
  - Sick
  - Pregnant women
  - People with respiratory disorders or heart problems
  - Smokers
  - Factory workers

- Four most dangerous indoor air pollutants:

  - ✓ Tobacco smoke
  - ✓ Formaldehyde
  - ✓ Radioactive radon-222 gas
  - ✓ Very small particles


Chloroform
Source: Chlorine-treated water in hot showers Possible threat: Cancer
Para-dichlorobenzene
Source: Air fresheners, mothball crystals
Threat: Cancer
Tetrachloroethylene
Source: Dry-cleaning fluid fumes on clothes
Threat: Nerve disorders, damage to liver and kidneys, possible cancer
Formaldehyde
Source: Furniture stuffing, paneling, particleboard, foam insulation
Threat: Irritation of eyes, throat, skin, and lungs; nausea; dizziness
1,1,1-Trichloroethane
Source: Aerosol sprays
Threat: Dizziness, irregular breathing
Styrene
Source: Carpets, plastic products
Threat: Kidney and liver damage
Nitrogen oxides
Source: Unvented gas stoves and kerosene heaters, woodstoves
Threat: Irritated lungs, children's colds, headaches
Benzo- α -pyrene
Source: Tobacco smoke, woodstoves
Threat: Lung cancer
Particulates
Source: Pollen, pet dander, dust mites, cooking smoke particles
Threat: Irritated lungs, asthma attacks, itchy eyes, runny nose, lung disease
Radon-222
Source: Radioactive soil and rock surrounding foundation, water supply
Threat: Lung cancer
Tobacco smoke
Source: Cigarettes
Threat: Lung cancer, respiratory ailments, heart disease
Asbestos
Source: Pipe insulation, vinyl ceiling and floor tiles
Threat: Lung disease, lung cancer
Carbon monoxide
Source: Faulty furnaces, unvented gas stoves and kerosene heaters, woodstoves
Threat: Headaches, drowsiness, irregular heartbeat, death
Methylene chloride
Source: Paint strippers and thinners Threat: Nerve disorders, diabetes

- Household dust mites that feed on human skin and dust. It can cause asthma attacks and allergic reactions in some people

- Radon-222, a radioactive gas found in some soils and rocks, can seep into some houses and increase the risk of lung cancer.