COMMUNITY MEDICINE

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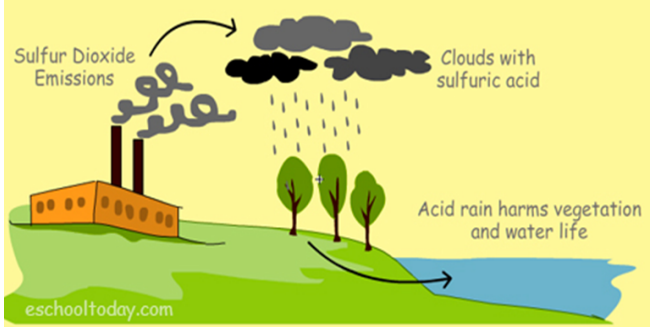
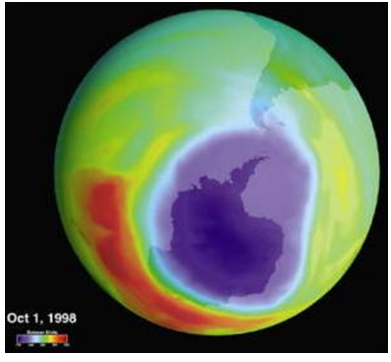
Air Pollution

WORLD ENVIRONMENT DAY

Beat Air Pollution





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تعليق الدكتوره على الصور

- Figure 1 : it shows what all we have : fingerprint ، so what can you provide to environment either positive or negative in our daily life
- Figure 2 :we can remember from it water cycle , it shows acidic rain
- Figure 3 : it shows ozone hole , which has been discovered at 1985 , and its healing right now a little bit

Note: doctor sireen Saied that numbers , statistics and percentages are important and we should to know what they mean

Facts about air pollution

- It is the deadliest form of pollution, killing millions of people each year.
- One of the most important topics , its deadliest مميت او مهلك , that killing millions of people every year
- Air pollution is the fourth-largest threat مهدد او خطر to human health, after high blood pressure, dietary risks and smoking. Air pollutions cause cause 4.2 million deaths
- 4.2 million deaths every year as a result of exposure to ambient (outdoor) air pollution (ambient air : outdoor) . يعني تلوث الهواء نوعين indoor and outdoor
- 3.8 million deaths every year as a result of household exposure to smoke from dirty cookstoves and fuels (in 2012, WHO). Its mainly at poor countries cause thy use firewood coal , and animal dung (dirty cookstoves : مواقد الطهي المتسخه ، المقصود هنا المواقد التي تستخدم مصادر من الوقود تؤذي بشكل مباشر داخل البيوت سواء بحرقها او غير ذلك مثل الفحم والخشب ومخلفات الحيوان
- That's 11.6% of all global deaths – more than the number of people killed by HIV/AIDS, tuberculosis and road injuries combined. Both of them (indoor and outdoor air pollutions represents 11.6 percent of global death)

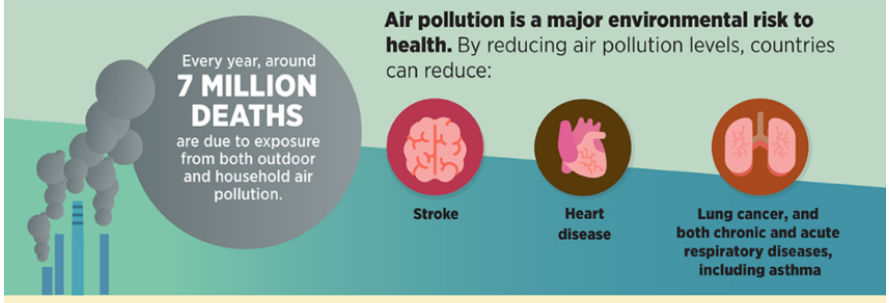
Facts about air pollution

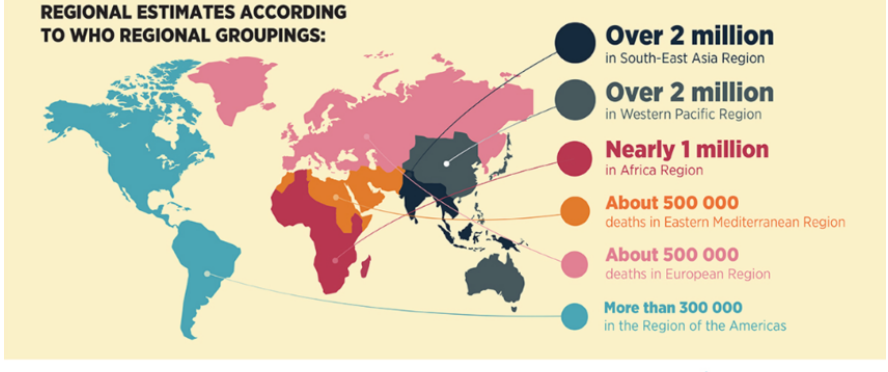
- Air pollution did cost the globe an estimated $8.1 trillion in 2019 in lost labor and income, equivalent to 6.1 percent of global GDP. Lost income: its term used when people get sick and will be off work , so it will be be extra cost for medical treatment due to diseases caused by air pollutions . GDP : gross domestic product الناتج المحلي الاجمالي
- 95 percent of deaths caused by air pollution occur in low- and middle- income countries . because developed countries make extreme measures to reduce air pollutions in large cities (where pollutions accumulate)

- Research shows that close links between air pollution and incidence of illness and death due to COVID-19. More than nine out of 10 of the world's population (92%) live in places where air pollution exceeds safe limits (WHO).
- 92percent live in areas with level of air pollutions exceeds the acceptable level

where 8 live in healthy areas

AIR POLLUTION – THE SILENT KILLER





CLEAN AIR FOR HEALTH #AirPollution World Health Organization

Significance of the Problem

- Around 3 billion people (more than 40% of the world's population))Worlds populations 7.8 (still do not have access to clean cooking fuels and technologies in their homes (causing indoor air pollution).
- So thy use at homes dirty types of fuels for cook and heat homes
- Parts of Africa, Eastern Europe, India, China and the Middle East are the biggest regional danger spots.
- WHO estimates that:

80% of these deaths were due to ischemic heart disease and strokes

14% of deaths were due to chronic obstructive pulmonary disease or acute lower respiratory infections

6% of deaths were due to lung cancer because of air pollutions

What is Air Pollution?

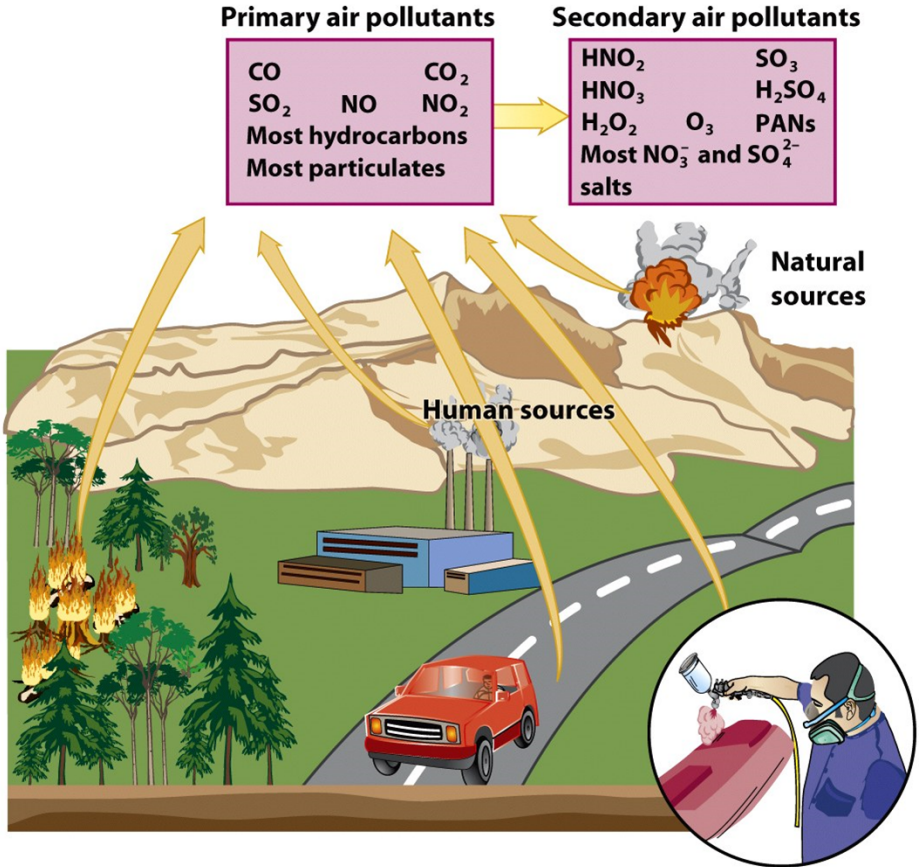
Air pollution occurs when gases, dust particles, fumes (or smoke) ابخره or odors are introduced into the atmosphere in a way that makes it harmful to humans, animals and plants.

Normally more of them in low concentrations at atmosphere but when they exceeds certain limits they will considered as pollutants

Definitions

Air pollutants are airborne gases, particles : very small solid particles cant be precipitate , and aerosols رذاذ small fluid particles and stay in air for long time and cant be precipitate . From sneezing , cough ..and then viruses will stay at them or chemical compounds that are added to the atmosphere by natural events like volcanos , forests fires ..or human activities in concentrations that threaten the well-being of organisms or disrupt the orderly functioning of the environment.

- **Primary air pollutants** pollute the air when emitted directly into the atmosphere. Once they enter ; they starts pollutions
- **Secondary air Pollutants** are created by chemical reactions between primary air pollutants in the atmosphere. May involve sunlight or a catalyst.


Primary air pollutants
CO
CO_2
SO_2
NO
NO_2
Most hydrocarbons
Most particulates
Secondary air pollutants
HNO_2
SO_3
HNO_3
H_2SO_4
H_2O_2
O_3
PANs
Most NO_3^- and SO_4^{2-} salts
Natural sources
Human sources

تعليق الدكتوره على الصوره

- Its an examples of industrial sources of pollutants
- Energy generation plants it’s the major source of air pollutions لهيك لازم تطفي الضوء كل ما تطلع من غرفه

The most common air pollutants

1. Oxides of Carbon
2. Volatile Hydrocarbons (VOC's)
3. Oxides of Nitrogen
4. Sulfur Compounds
5. Photochemical Smog
6. Suspended Particulates (aerosols)

1. Oxides of Carbon

Oxides of Carbon: odorless, colorless لا لون ولا رائحه

1. Carbon dioxide (CO_2):

    fourth most common atmospheric gas (naturally)

    produced from oxidation (take O_2 and give CO_2) of hydrocarbons (burning fuel, solid waste, trees, …). although its greenhouse gas , but naturally exist with certain level of concentrations , if exceeds it will be pollutant

    asphixiant خانق constriction of airway

    greenhouse gas (contributes to global worming (global worming: causes climate changes with large sequences))

2. Carbon monoxide (CO): its more dangerous than CO_2 cause low concentration of it will be toxic

    toxic in low concentrations

    produced by incomplete combustion of fossil fuels. when old cars and machines cant burn fuels efficiently it release large amount of CO

2. Volatile Hydrocarbons: (VOC's)

Volatile متطاير Hydrocarbons

1. Methane (A greenhouse gas): Mostly natural sources (marshes الاهوار plants covered with water all time , ruminant animals المجتر like cows when it take grass and convert it into methane by fermentation reaction, rice paddies مزارع الارز, trees), (livestock manure روث الماشية
2. and agricultural practices, decay تحلل of organic waste in landfills مقالب القمامة , production of coal and natural gas). Naturally exist but at high level is considered greenhouse gas

2. Benzene, tetrachloroethylene : washing machines using tetrachloroethylene instead of water (dry-cleaning), gasoline which we put at our cars and little amount of benzene so its not like as a common , formaldehyde, many others: products of chemical industry used as solvents, in paints, and as cleaning agents.

- All may form secondary pollutants that irritate eyes and damage respiratory system (photochemical smog : smoke and fog). Usually at summer at cities with high air pollutions ; other compounds interacts and form smog which is bad to health

3. Oxides of Nitrogen

1. Nitric Oxide (NO)

Produced by soil microbes

Forms NO_2 in combination with oxygen in atmosphere

Its normal , no problem of it

2. Nitrous Oxide (N_2O)

Natural and man made sources مصادر من صنع الإنسان

Anesthetic **in medicine** تخدير

Its laughing gas used at dentistry for little children and procedures

Greenhouse gas

3. Nitrogen Dioxide (NO_2) worst of them

Formed in auto engines محركات السيارات

and electrical generating plants.

Contributes to heart, lung, liver and kidney diseases at high concentration

Responsible for brownish haze (photochemical smog)

Forms nitric acid in rainwater (acidic rain) **because it dissolve in water at atmosphere and then become acidic rain which cause damage of trees , bird eggs ….**

4. Compounds of Sulfur

Compounds of Sulfur:

1. Sulfur Oxides (SO2, SO3, SO4): it come from natural sources like

volcanoes, sea spray رذاذ البحر, combustion of fossil fuels (coal) coal its really dirty than other types of fusel fuels

Irritate respiratory passages (SO2)

Form acidic aerosols, acid rain (SO3, SO4), damages lakes : its not very large and water cant changes , enclosed so sulfur will convert it into highly acidic water which will affect its animals like fishes .., forests, steel and stone structures.

2. Hydrogen Sulfide (H2S) it has bad smell and usually not produced by auto engines but sewer systems صرف صحي

Gas produced in anaerobic environment. It is colorless with bad odor "rotten egg", (sewer gas غاز الصرف الصحي). It is highly toxic (eye irritant and asphixiant) and extremely flammable قابل للاشتعال

5. Photochemical Smog

- Forms in bright sunlight **from interaction between :**
  - nitrogen oxides
  - Hydrocarbons (VOCs)
  - oxygen
- Interact chemically to produce powerful oxidants like ozone (O3) and peroxyacetyl nitrate (PAN).
- These secondary pollutants **O3 and PAN** are damaging to plant life and lead to the formation of photochemical smog (smoke + fog).
- PAN and ozone are primarily responsible for the eye irritation so characteristic of this type of smog, in addition to reducing visibility.

Ozone

- Tropospheric Ozone
  - Man- made pollutant in the lower atmosphere
  - Secondary air pollutant
  - Component of photochemical smog
- Stratospheric Ozone its good O3
  - Essential component that screens out UV radiation in the upper atmosphere UV is harmful for people and could cause skin cancer
  - Man- made pollutants (ex: CFCs : chlorofluorocarbons*) can destroy it.

* CFC's are gases used in refrigeration and in pressured spray cans .

6. Suspended Particles (suspended mean very small , light weight and cant precipitate)

Particulate mater (PM) (solid , small particles) : Thousands of different solid or liquid particles suspended in air. It includes dust, fungal spores, ammonia, sodium chloride, lead its fumes , which increase performance of gasoline at cars and come out from car exists and it stays at air so, Jordan try to have unleaded cars , asbestos الحرير الصخري some people at residential areas use it for insulation heat but it has founded that it stay at air and cause lung cancer , black carbon (soot السخام) black bad dark fumes from old cars and it precipitate at lungs and cant even go out , soil particles, and sulfuric acid droplets which is sulfur air pollutants dries out with water long long precipitate as particles .

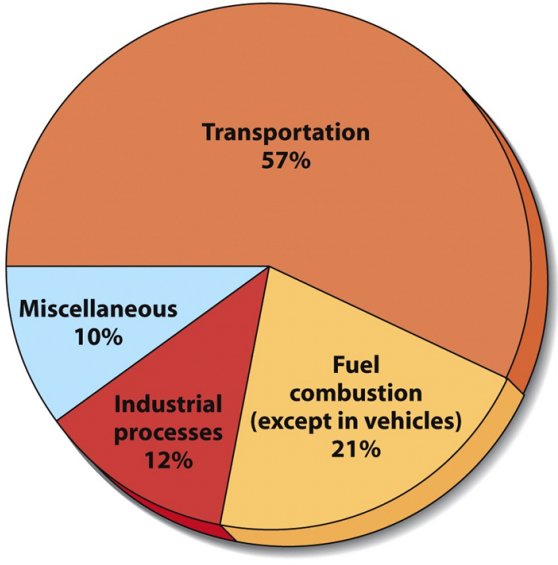
- **PM affects more people than any other pollutant its more dangerous for lot of people compared to other particles (its the worst).**
- **The most health-damaging particles are those with a diameter of 10 microns or less, (≤ PM_{10}), which can penetrate and lodge deep inside the lungs.**
- **Greatest threat to health among air pollutants.**

What are the sources of air pollution?

Three main sources of air pollution:

1) Transportation
2) Power plants: electricity generating
3) Industry

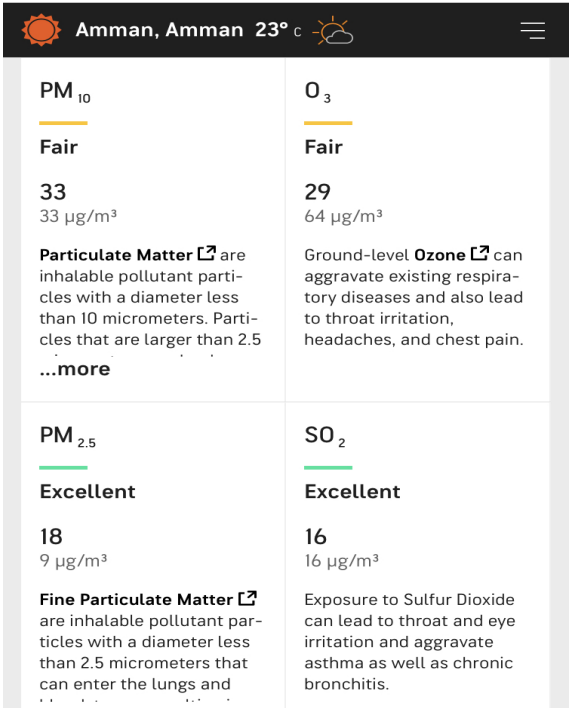
4 miscellaneous

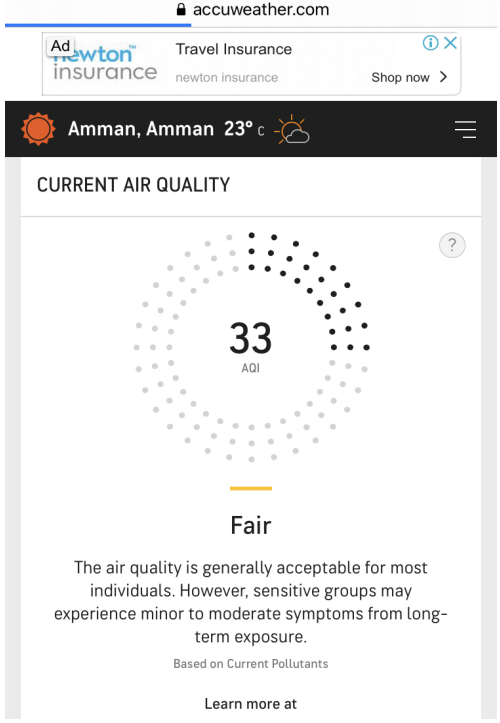


Air Pollution in Beijing and Mexico City

- Beijing (left)
- Mexico City (above)

Air quality indicators in Amman, Jordan on November 2 nd, 2021:





Climate Change and Global Warming:

Climate changes like global warming is the result of human practices like emission of Greenhouse gases(fossil fuel use) and deforestation .

- Global warming leads to rising temperatures of the oceans and the earth' surface causing:

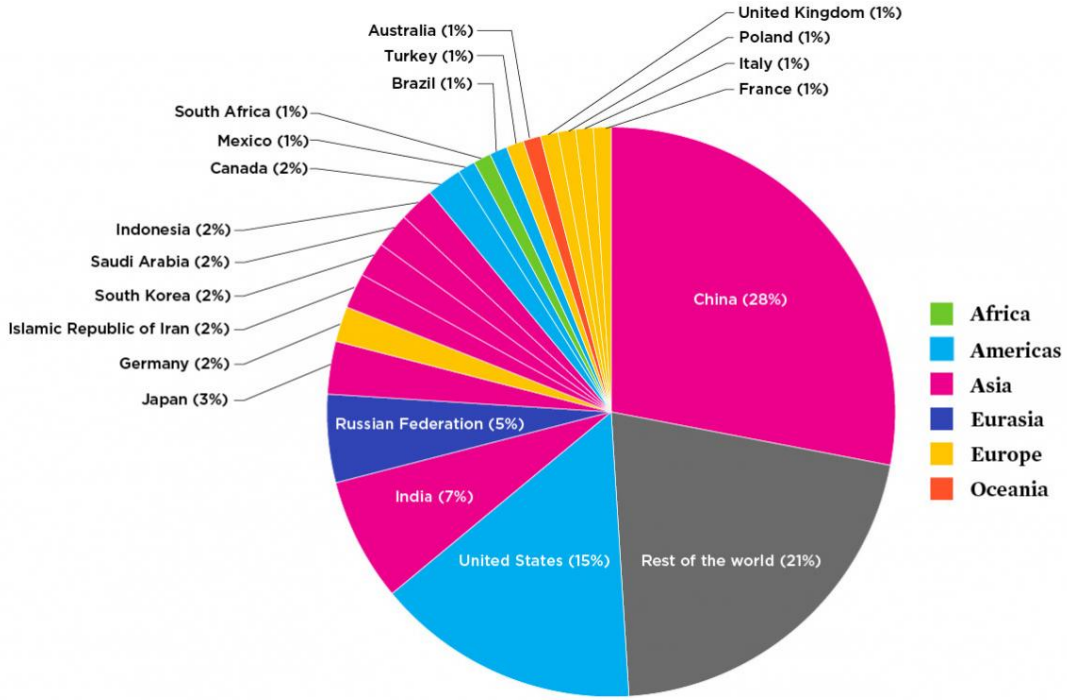
1. Melting of polar ice caps
2. Rise in sea levels and also
3. Unnatural patterns of rain such as flash floods السيول , excessive snow or desertification التصحر in other areas, changing seasons, change in weather scenario, and occurrence of new diseases .

Global Warming:

These gases possess heat trapping capacity القدرة على احتجاز الحرارة that are needed to create greenhouse effect so that this planet remains warm for people to survive.

- During past several decades, the accumulation of greenhouse gases have grown rapidly, which means more heat gets trapped in the atmosphere and few of these gases escapes back into the space.
- These gases heat up the earth's surface and this results in global warming. The earth's temperature has increased by 0.8 degrees Celsius over the past century.

Share of CO2 emissions by country: Carbon Footprint



Acid Deposition

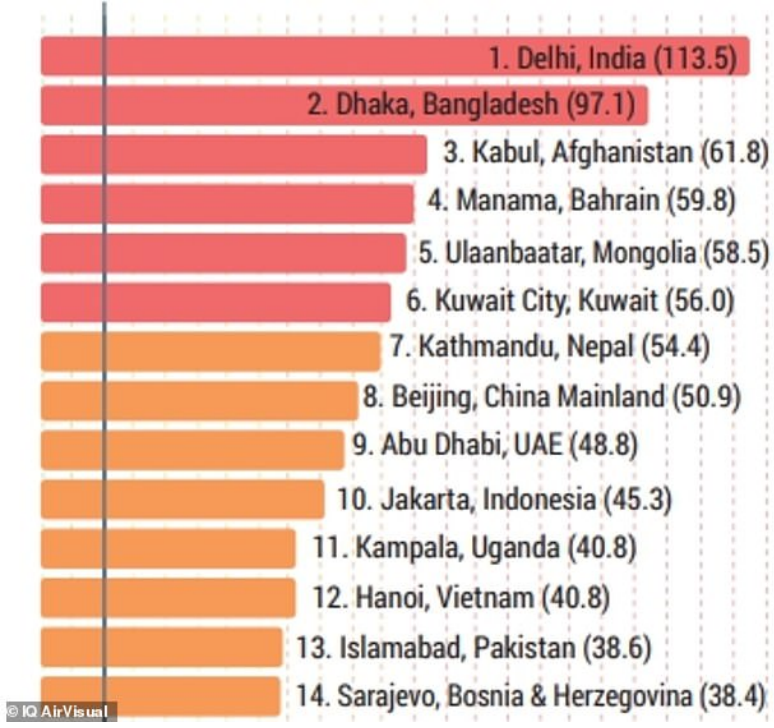
Sulfur dioxide and nitrogen dioxide emissions react with water vapor in the atmosphere and form acids that return to the surface as either dry or wet deposition (droplets).

Effects of Acid Deposition

- **Declining Aquatic Animal Populations تناقص أعداد الحيوانات المائية**

- **Damages lakes and streams**
- **Thin-shelled eggs prevent bird reproduction**
- **Damages building and objects**
- **Forest decline (deforestation)**
  - **Ex: Black forest in Germany (50% is destroyed)**

Most polluted capitals in the world In 2018:



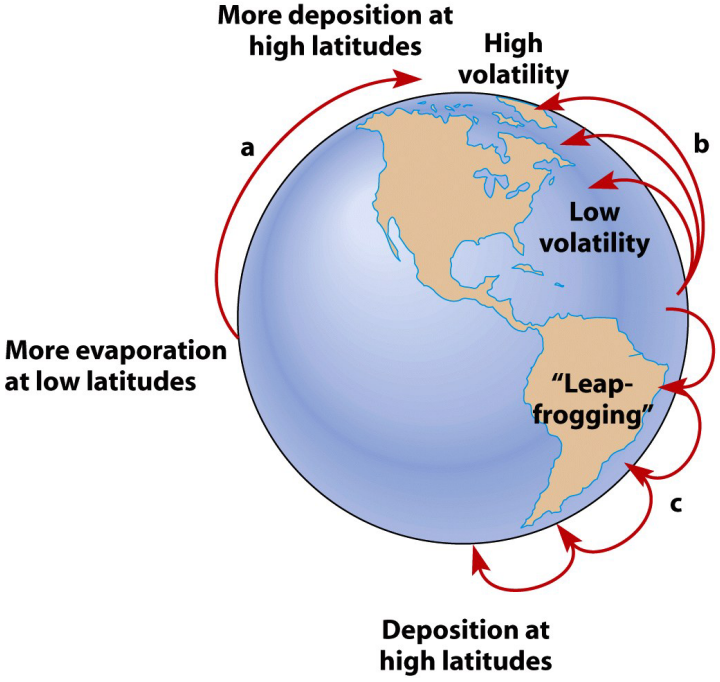
Agricultural Effects of Air pollution

- Air pollution can seriously affect the growth of plants.
- It is easy to find chemical residues in plants that grow alongside highways.
- Also, the huge increase in atmospheric carbon dioxide now causing **global warming**, and climate change is expected to have a major impact on the world's agriculture (reducing crop yields in some places but potentially increasing yields elsewhere).

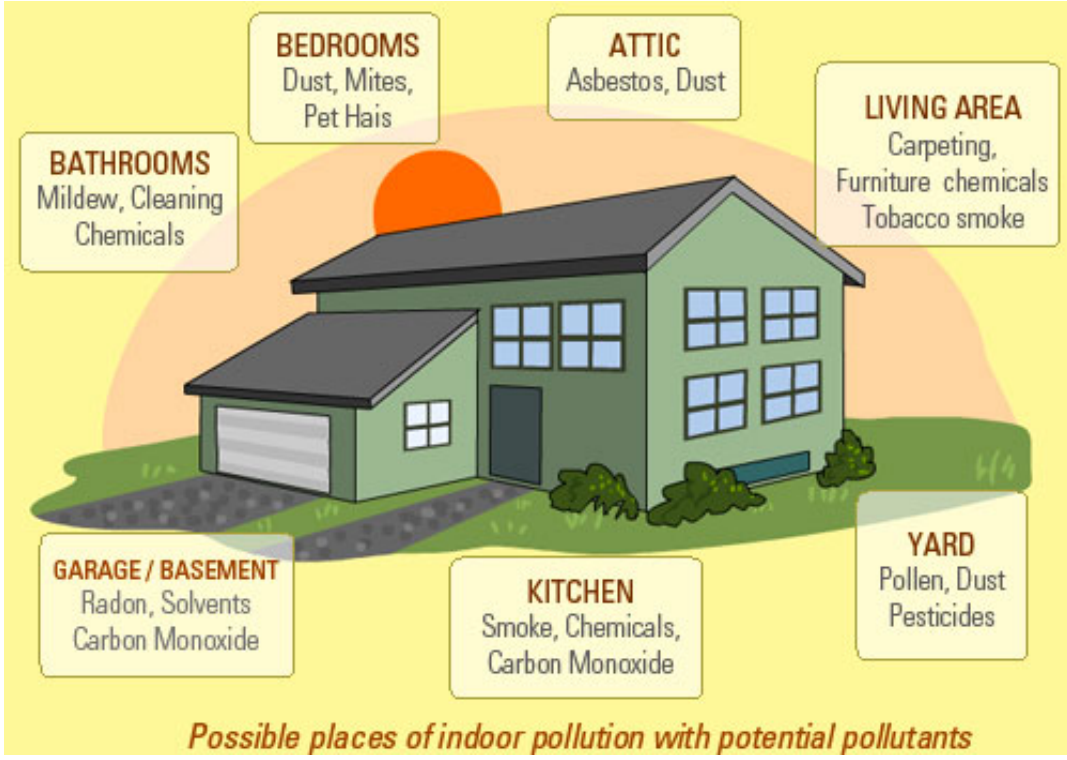
Air Pollution Around the World

- Air quality is deteriorating تدهورrapidly in developing countries
- Shenyang, China
  - Residents only see sunlight a few weeks each year
- Developing countries have older cars
- Still use leaded gasoline

Long Distance Transport of Air Pollutants



Indoor Air Pollution



Indoor Air Pollution

- Around 3 billion people cook and heat their homes using open fires and leaky stoves, and burning biomass (wood, animal dung and crop waste) and coal.
- Nearly 3.5 million people die prematurely from illness attributable to indoor air pollution from household solid fuel use (e.g. chronic obstructive respiratory disease).
- Nearly 50% of pneumonia deaths among children under five are due to particulate matter inhaled from indoor air pollution.
- Both women and men exposed to heavy indoor smoke are 2-3 times more likely to develop COPD

Source: WHO: http://www.who.int/mediacentre/factsheets/fs292/en/

Indoor Air Pollution

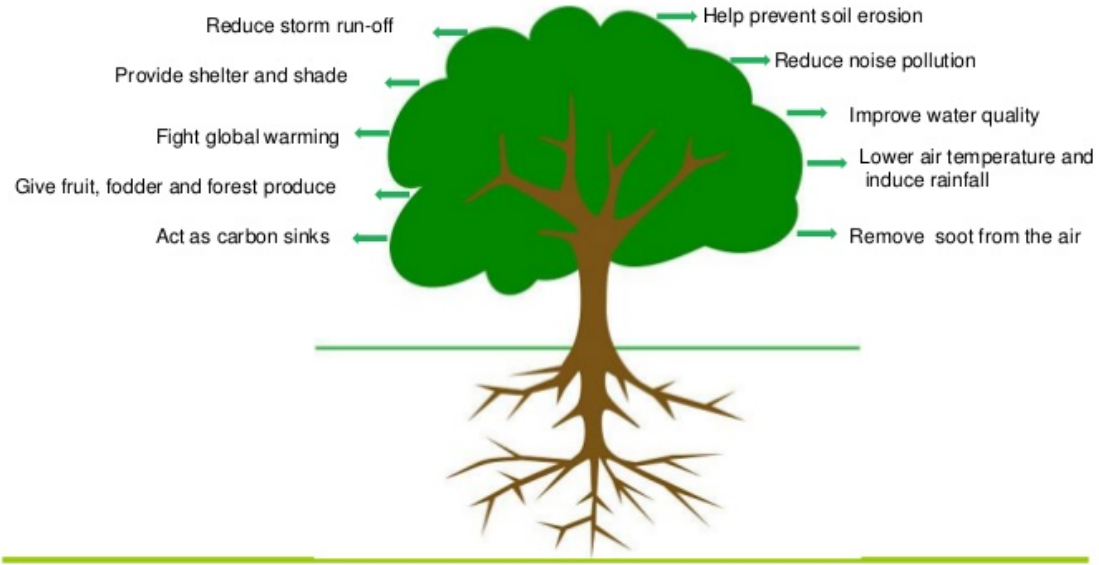
Common indoor air pollutants include:

- **Tobacco smoke:** دخان التبغ او السجاير
- This is smoke burning cigarettes سجائر or exhaled smoke by people smoking.
- **Biological Pollutants:** These include allergens such as pollen from plants, hair from pets, fungi and some bacteria.
- **Radon:** This is a gas that is naturally emitted from the ground. Radon can be trapped in basements of building and homes. The gas is known to cause cancer after exposure over a period.
- **Carbon Monoxide:** Carbon monoxide is produced when fuels such as gas, kerosene, coal or wood is incompletely burned or with lack of indoor ventilationتهوية داخلية

How can we solve the problem of air pollution?

1. Technological Solutions: cars and factories with less pollution, and using all types of renewable energy.
2. Laws and Regulations
3. Raising awareness and changing human behavior……

Why Trees?


Reduce storm run-off
Provide shelter and shade
Fight global warming
Give fruit, fodder and forest produce
Act as carbon sinks
Help prevent soil erosion
Reduce noise pollution
Improve water quality
Lower air temperature and induce rainfall
Remove soot from the air