Environmental Health

WORLD ENVIRONMENT DAY | UN environment

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COMMUNITY MEDICINE, FIRST SEMESTER 2021/ 2022

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Environmental Health

- ✓ Across the world, the environment is a key determinant of health and well-being.
- ✓Globally, nearly 25 percent of all deaths and total disease burden can be attributed to environmental factors.
- ✓Unimproved water and sanitation, ambient air pollution, indoor pollution from solid fuels, and lead exposure are among the leading contributors to global burden of disease.
- ✓In addition, many current and emerging exposures in food, water, soil, air, and consumer products adversely affect human health.

Why Is Environmental Health Important?

Maintaining a clean healthy environment is central to increasing quality of life and years of healthy life.

The burden of preventable environmental diseases are disproportionately felt by residents of poor developing countries.

The reasons for this disproportionate effect in poor countries include: lack of modern technology, weak protective environmental laws and regulations, a lack of awareness, and poverty.

WHO Definition of Environmental Health

It refers to the theory and practice of assessing, correcting, controlling, and preventing those factors in the environment that can potentially affect adversely the health of present and future generations.

What Is Environmental Health Science?

"The study of those **factors** in the environment that affect human **health**" under these conditions:

Factors ("pollutants" or "toxicants" = Hazard) in air, water, soil, or food … that human activities produce.

Transferred to humans by inhalation, ingestion, or absorption (exposure).

Production of adverse health effects as a result of that exposure.

Basic Requirements for a Healthy Environment

Clean air

Safe and sufficient water

Safe and adequate food

Safe and peaceful settlements

Stable global environment

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UNEP

5 JUNE

Forests: Nature at Your Service

In support of the UN International Year of Forests


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IF YOU CAN'T REUSE IT,
REFUSE IT
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GREENING THE BLUE.

Transmission toward more environmental sustainability:

Greenhouse gas emissions

Waste disposal

Water

World Environment Day 2021: June 5th

Theme for 2021:
” Ecosystem Restoration”

Basic terminology:

Hazards

- ✓ Things in the environment that are harmful are called **hazards** and include things like chemicals, disease-causing bacteria, loud noises and even stress in our life.
- ✓ hazards can be natural or human-made.

Hazards in the Environment

Chemical: Air pollutants, toxic wastes, pesticides, VOCs

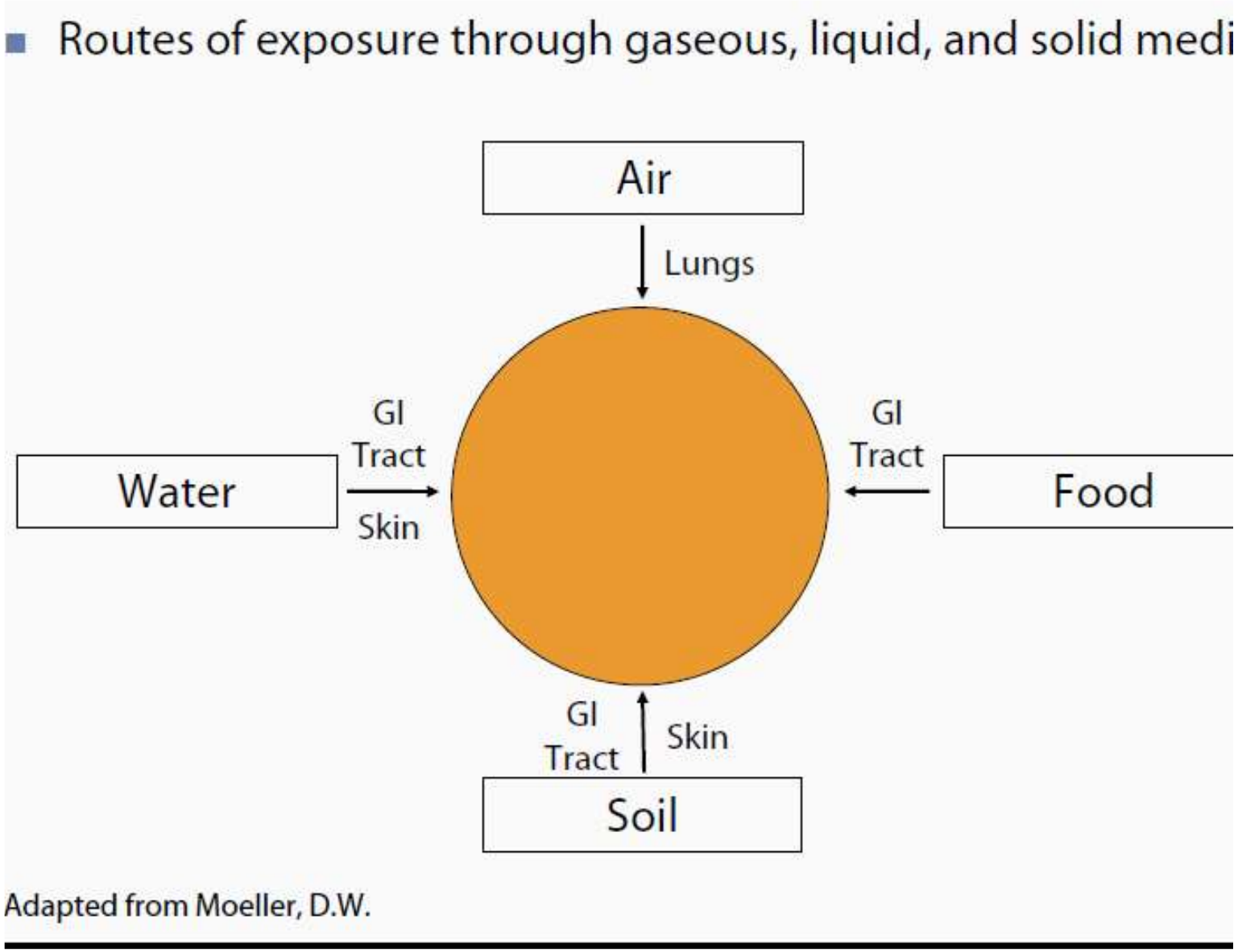
Biological: Disease organisms present in food and water, also Insect and animal allergens

Physical: Noise, ionizing and non-ionizing radiation

Socioeconomic: Access to safe and sufficient health care

Routs of exposure

How do hazards get transformed to our bodies????



Health Effects of Hazards

Adverse vs. beneficial

Acute vs. delayed onset

Clinical vs. subclinical manifestations

Transient (reversible) vs. chronic (irreversible)

Examples of Manifestations

Lung disease

Reproductive effects

Teratogenic effects

Neurologic effects

Immunosuppression and hypersensitivity

Cancer

Vulnerable Groups (susceptible)

Low socioeconomic status

Women

Children

Elderly

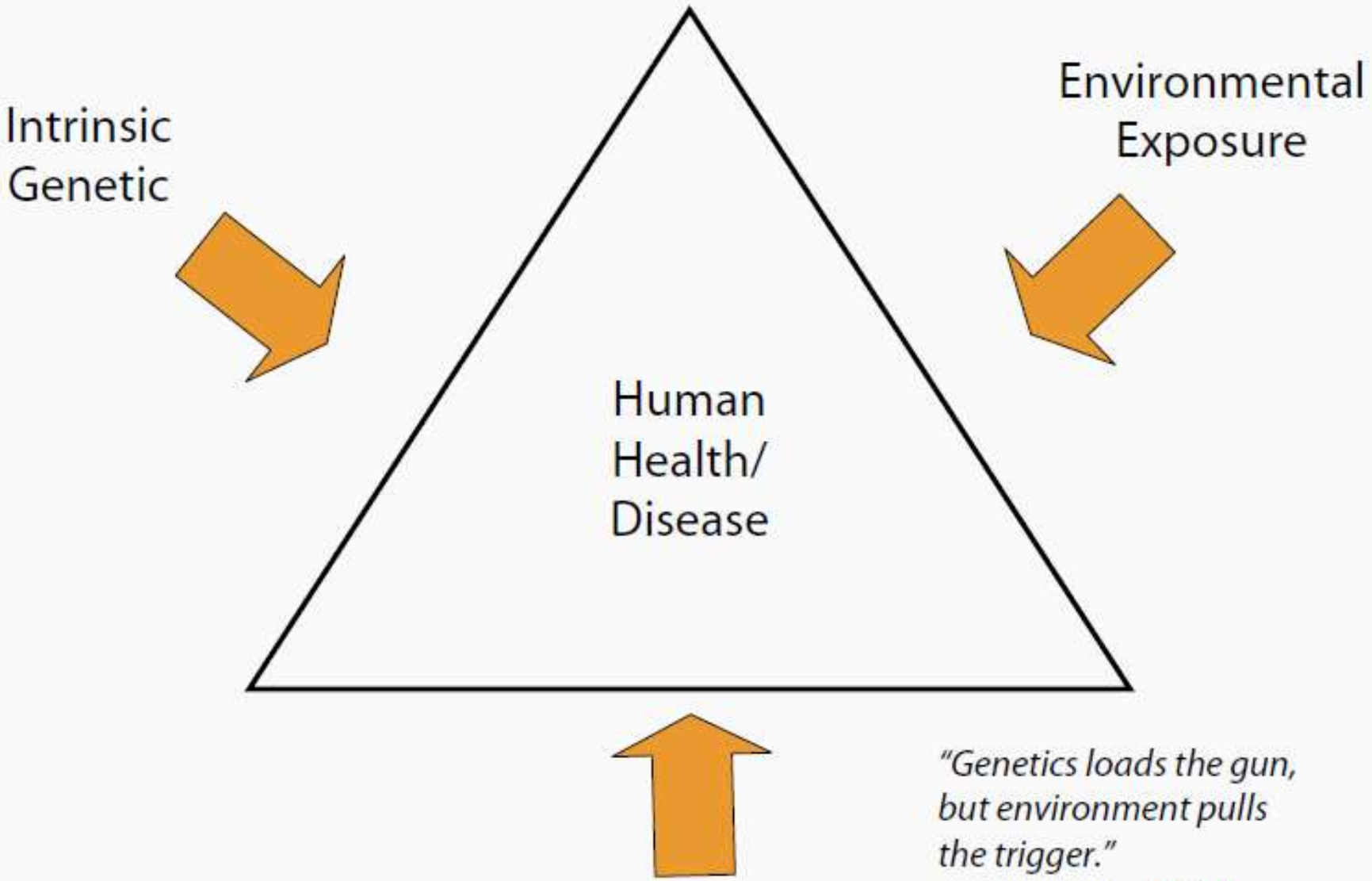
Ethnic minorities

Disabled

Indigenous peoples

- ❑ All of whom are often more vulnerable because of Genetics or They are not empowered to change their environment

Environment Pulls the Trigger



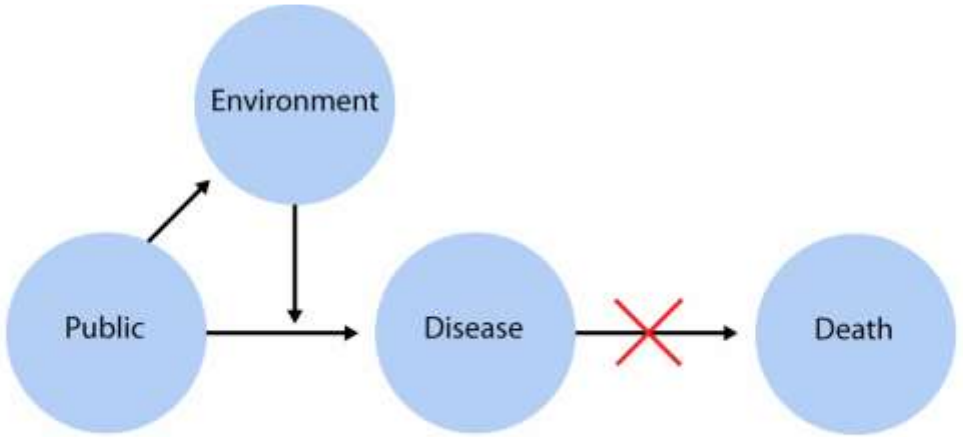
"Genetics loads the gun, but environment pulls the trigger."

— Judith Stern
UC Davis

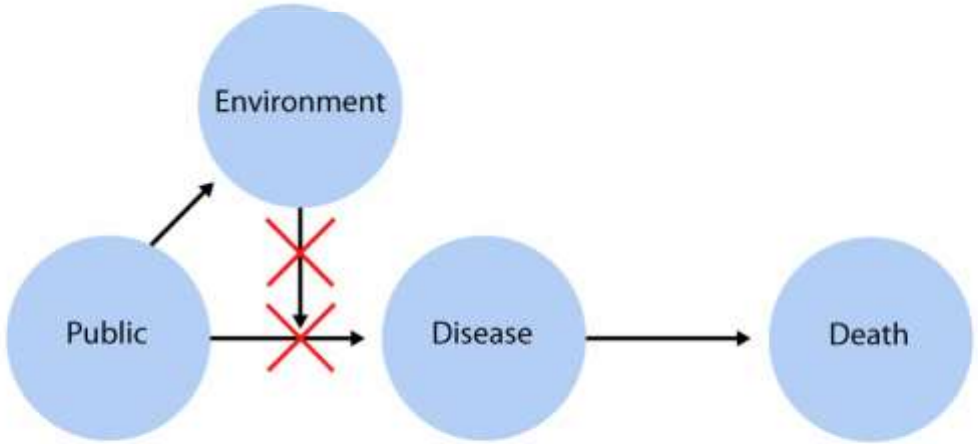
Problem Solving Paradigm: six steps

1.	Define the problem	Risk assessment
2.	Measure its magnitude	
3.	Understand key determinants	
4.	Develop intervention/ prevention strategies	Risk management
5.	Set policy/priorities	
6.	Implement and evaluate	

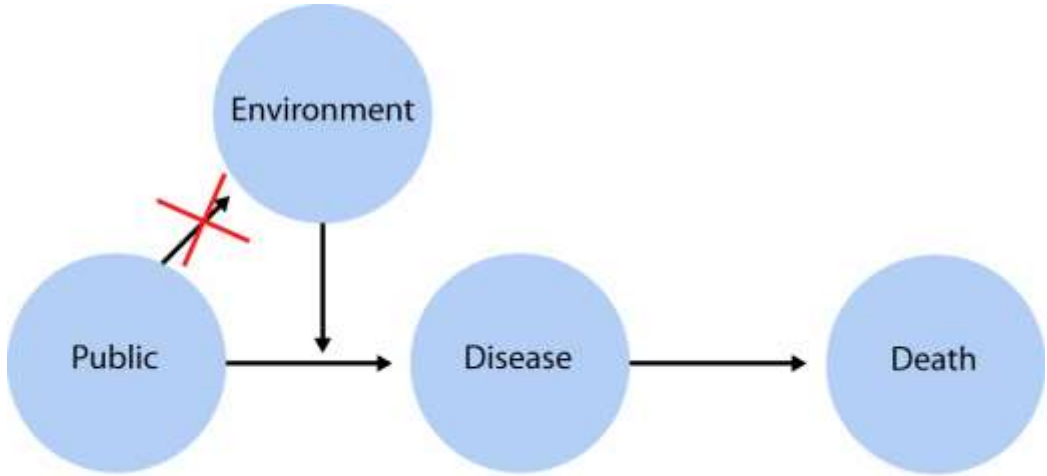
Improving Human Health and Environment: 3 Models



Clinical Intervention Model



Public Health Intervention Model



Environmental Stewardship Model

Prevention and Control Methods

- ✓ First choice control method: is usually the most effective and easiest to implement, and produces the largest benefit at the lowest cost.
- ✓ Continued progress requires using more and more expensive methods that remove smaller amounts of pollutant
- ✓ At some point, with more preventive measures, costs will outweigh benefits

The 6 Themes of Environmental Health: Healthy People 2020

The Healthy People 2020 Environmental Health objectives focus on 6 themes, each of which highlights an element of environmental health:

1) Outdoor air quality
2) Surface and ground water quality
3) Toxic substances and hazardous wastes
4) Homes and communities
5) Infrastructure and surveillance
6) Global environmental health

What is environmental justice?

Environmental Justice (EJ) means that everyone has a right to live in an environment that doesn't make them sick, regardless of their race, culture, or income.

Environmental Justice

Unfortunately, some neighborhoods or communities are exposed to more environmental hazards than others, and may suffer higher rates of health problems.

These communities often have less economic or political power in society when decisions are made.

For example, toxic waste dumps, polluting factories, and busy highways are often built in lower-income neighborhoods or communities of color.

For the first time, world leaders promise to end deforestation by 2030, and to reduce emissions by 30% by 2030 (compared to 2020 levels).

Air Pollution

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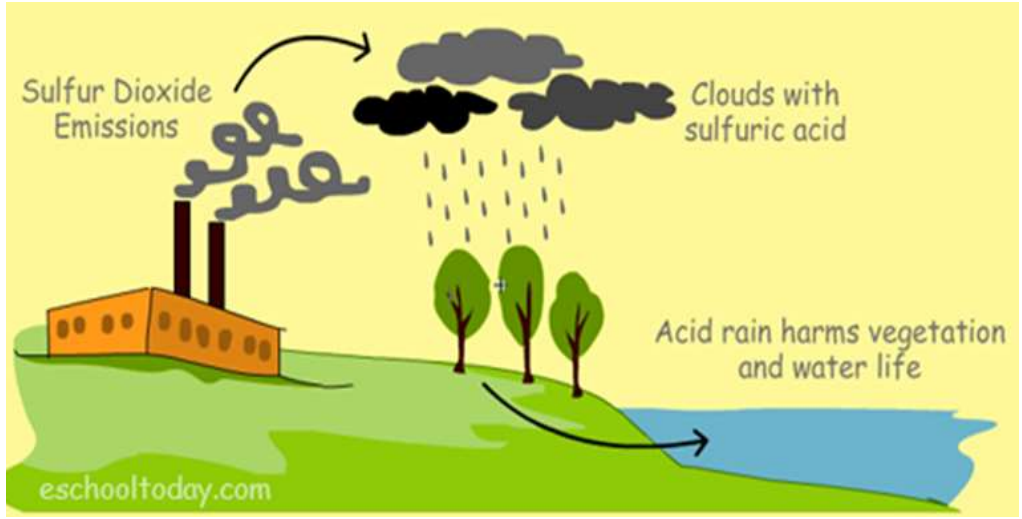
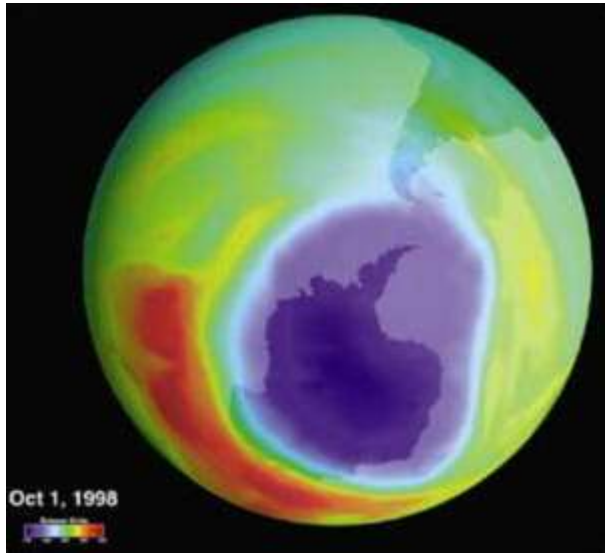
Beat Air Pollution





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Facts about air pollution

- It is the deadliest form of pollution, killing millions of people each year.
- Air pollution is the fourth-largest threat to human health, after high blood pressure, dietary risks and smoking.
- 4.2 million deaths every year as a result of exposure to ambient (outdoor) air pollution
- 3.8 million deaths every year as a result of household exposure to smoke from dirty cookstoves and fuels (in 2012, WHO).
- That's 11.6% of all global deaths – more than the number of people killed by HIV/AIDS, tuberculosis and road injuries combined.

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.
- 95 percent of deaths caused by air pollution occur in low- and middle- income countries.
- 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).

AIR POLLUTION – THE SILENT KILLER

Every year, around **7 MILLION DEATHS** are due to exposure from both outdoor and household air pollution.

Air pollution is a major environmental risk to health. By reducing air pollution levels, countries can reduce:

Stroke

Heart disease

Lung cancer, and both chronic and acute respiratory diseases, including asthma

REGIONAL ESTIMATES ACCORDING TO WHO REGIONAL GROUPINGS:

Over 2 million in South-East Asia Region

Over 2 million in Western Pacific Region

Nearly 1 million in Africa Region

About 500 000 deaths in Eastern Mediterranean Region

About 500 000 deaths in European Region

More than 300 000 in the Region of the Americas

CLEAN AIR FOR HEALTH #AirPollution World Health Organization

Significance of the Problem

- Around 3 billion people (more than 40% of the world's population) still do not have access to clean cooking fuels and technologies in their homes (causing indoor air pollution).
- 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

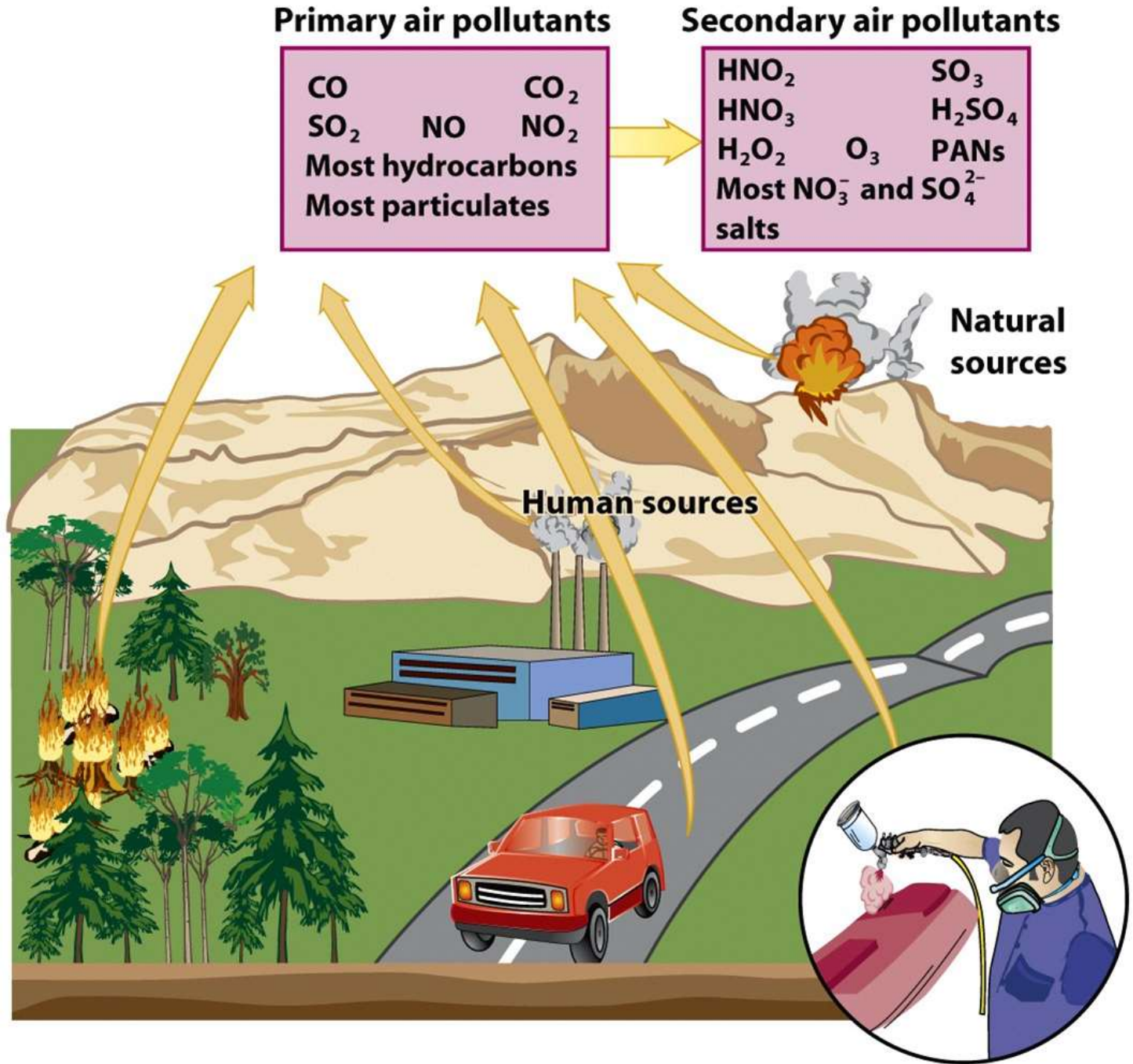
What is Air Pollution?

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

Definitions

Air pollutants are airborne gases, particles, and aerosols that are added to the atmosphere by natural events 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.
- **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

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

1. Carbon dioxide (CO_2):

    fourth most common atmospheric gas (naturally)

    produced from oxidation of hydrocarbons (burning fuel, solid waste, trees, …).

    asphixiant

    greenhouse gas (contributes to global worming)

2. Carbon monoxide (CO):

    toxic in low concentrations

    produced by incomplete combustion of fossil fuels.

2. Volatile Hydrocarbons: (VOC's)

Volatile Hydrocarbons

1. Methane (A greenhouse gas): Mostly natural sources (marshes, ruminant animals, rice paddies, trees), (livestock manure and agricultural practices, decay of organic waste in landfills, production of coal and natural gas).

2. Benzene, tetrachloroethylene, gasoline, 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).

3. Oxides of Nitrogen

1. Nitric Oxide (NO)

- Produced by soil microbes
- Forms NO_2 in combination with oxygen in atmosphere

2. Nitrous Oxide (N_2O)

- Natural and man made sources
- Anesthetic
- Greenhouse gas

3. Nitrogen Dioxide (NO_2)

- Formed in auto engines 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)

4. Compounds of Sulfur

Compounds of Sulfur:

1. Sulfur Oxides (SO_2, SO_3, SO_4):

volcanoes, sea spray, combustion of fossil fuels (coal)

Irritate respiratory passages (SO_2)

Form acidic aerosols, acid rain (SO_3, SO_4), damages lakes, forests, steel and stone structures.

2. Hydrogen Sulfide (H2S)

Gas produced in anaerobic environment. It is colorless with bad odor “rotten egg”, (sewer gas). It is highly toxic (eye irritant and asphixiant) and extremely flammable.

5. Photochemical Smog

- ✓ Forms in bright sunlight from:
  - nitrogen oxides
  - Hydrocarbons (VOCs)
  - oxygen
- ✓ Interact chemically to produce powerful oxidants like ozone (O3) and peroxyacetyl nitrate (PAN).
- ✓ These secondary pollutants 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
  - Essential component that screens out UV radiation in the upper atmosphere
  - Man- made pollutants (ex: CFCs*) can destroy it.
  - *CFC's are gases used in refrigeration and in pressured spray cans.

6. Suspended Particles

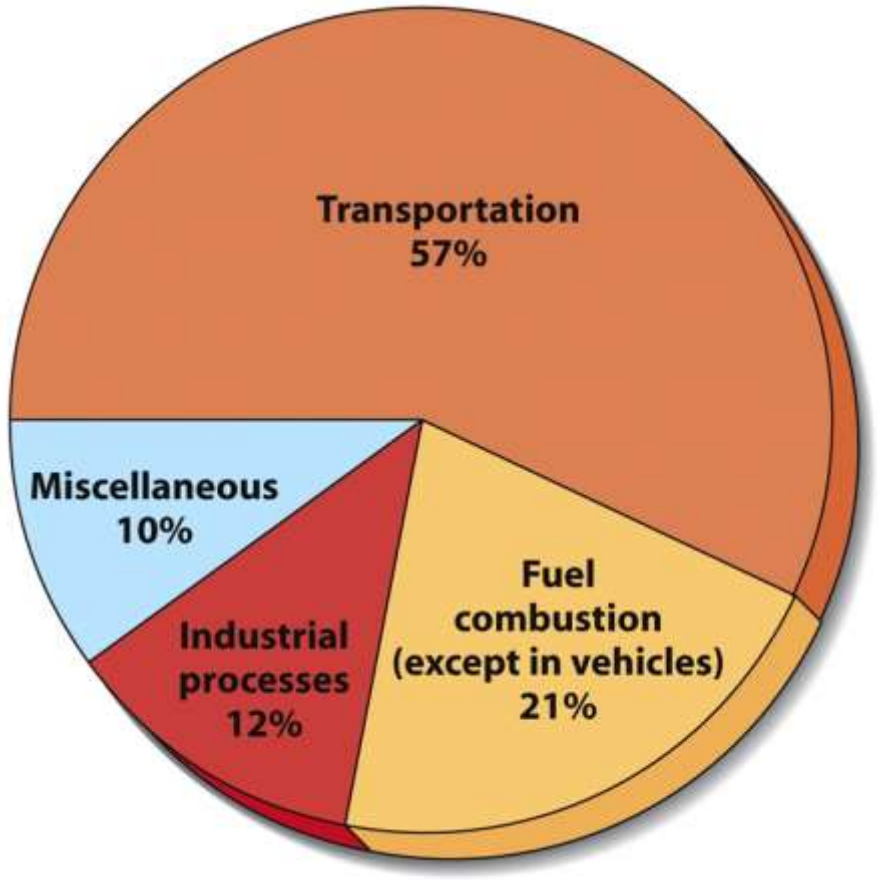
Particulate mater (PM): **Thousands of different solid or liquid particles suspended in air. It includes dust, fungal spores, ammonia, sodium chloride, lead, asbestos, black carbon (soot), soil particles, and sulfuric acid droplets.**

- ✓ **PM affects more people than any other pollutant.**
- ✓ **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.**
- ✓ **Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases, as well as of lung cancer.**

What are the sources of air pollution?

Three main sources of air pollution:

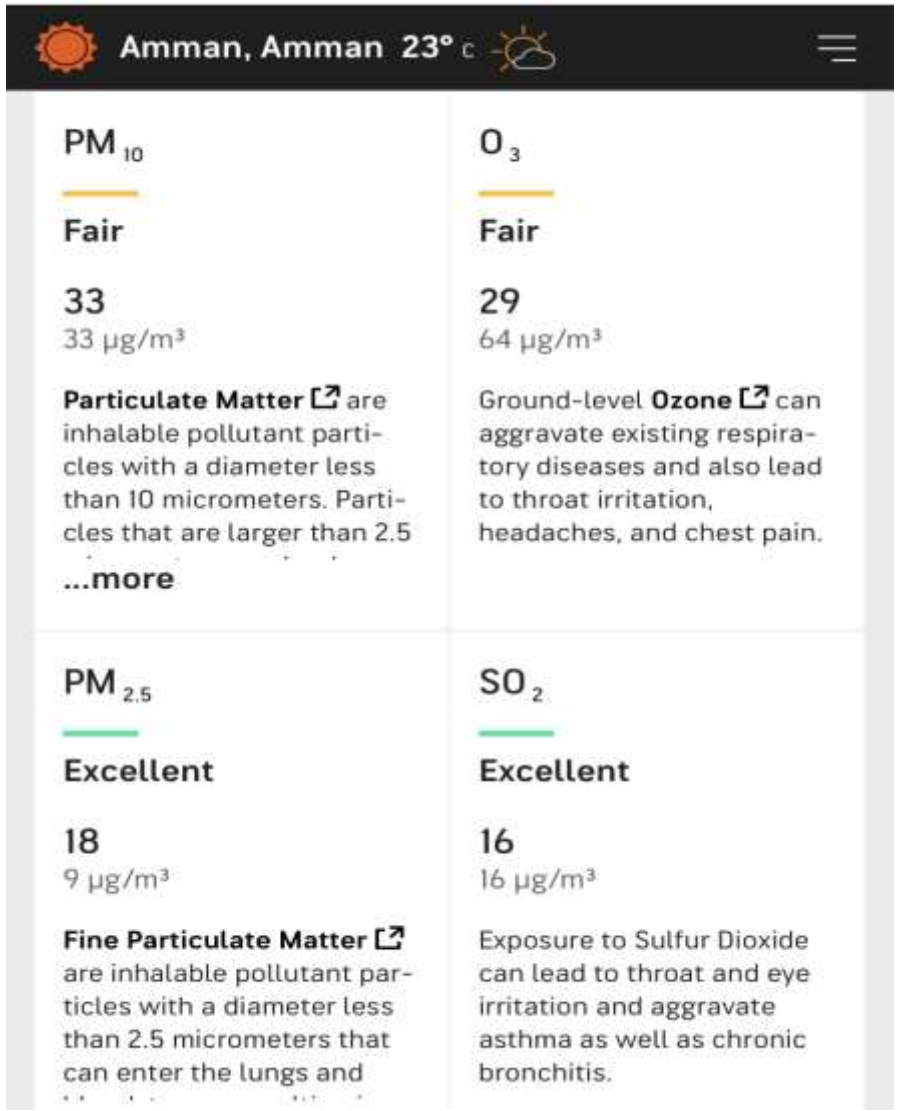
1) Transportation
2) Power plants: electricity generating
3) Industry



Air Pollution in Beijing and Mexico City

- Beijing (left)
- Mexico City (above)

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

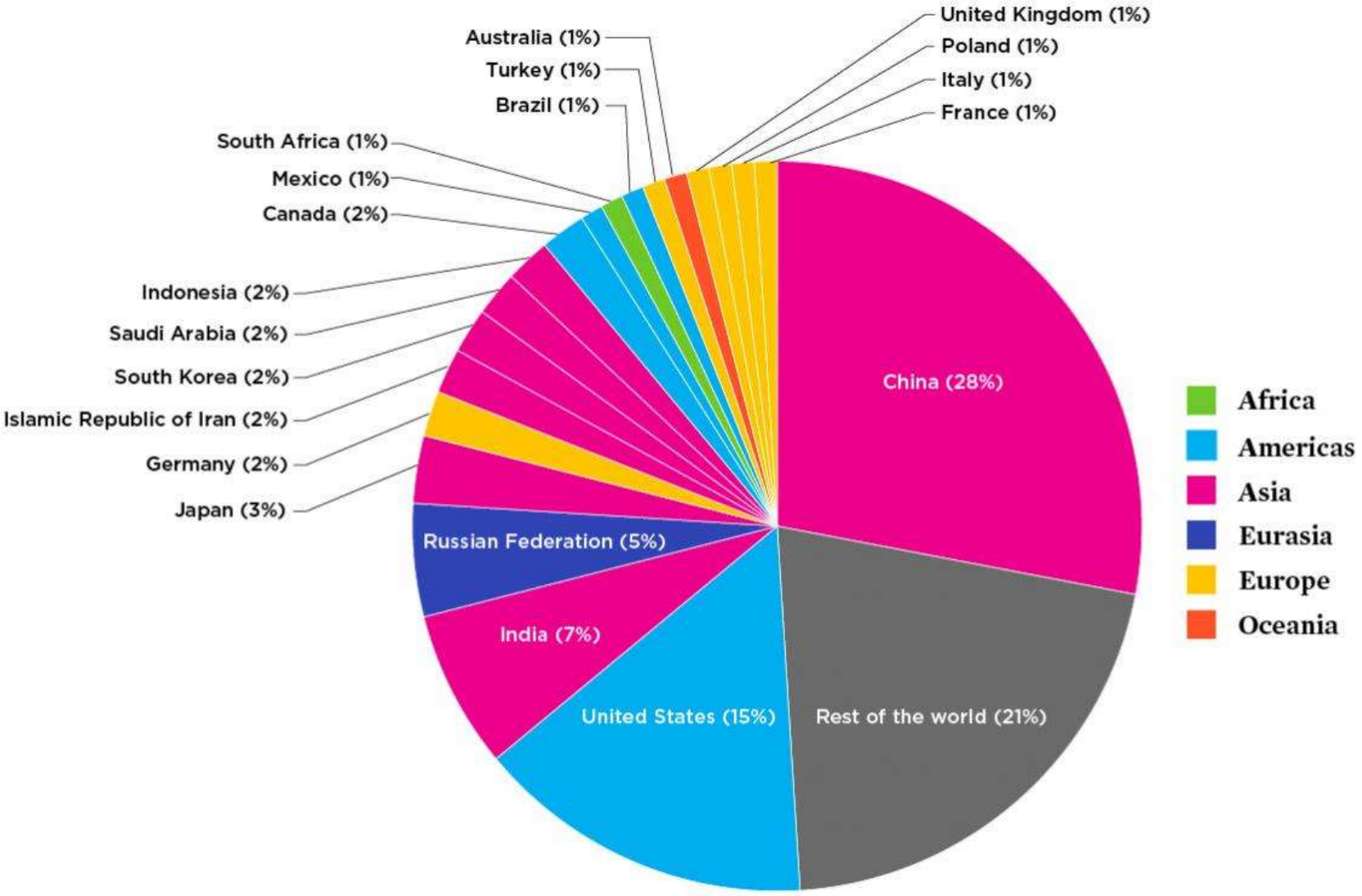
1. Melting of polar ice caps
2. Rise in sea levels and also
3. Unnatural patterns of rain such as flash floods, excessive snow or desertification in other areas, changing seasons, change in weather scenario, and occurrence of new diseases.

Global Warming:

These gases possess heat trapping capacity 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



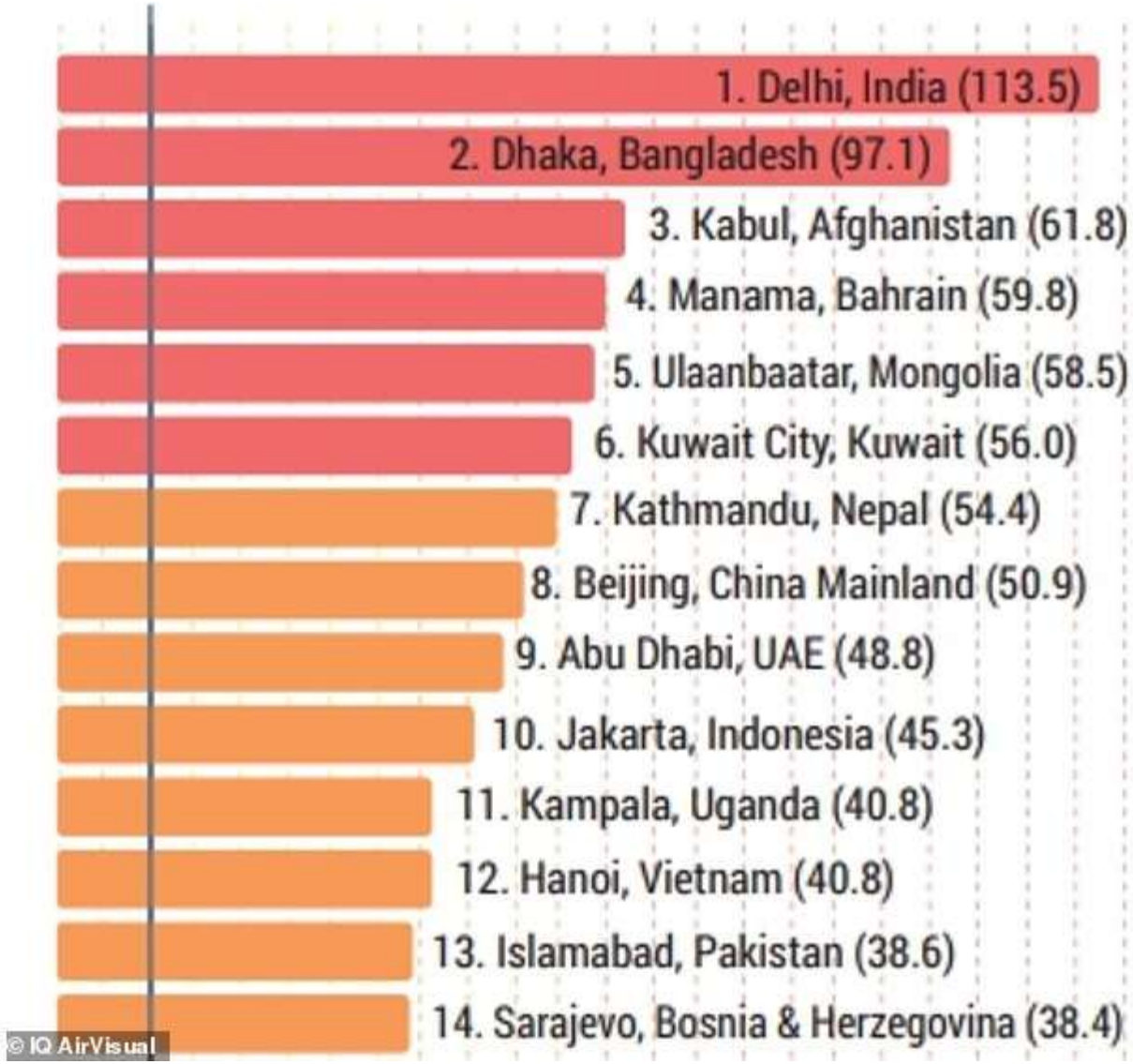
Acid Deposition

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
- 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:



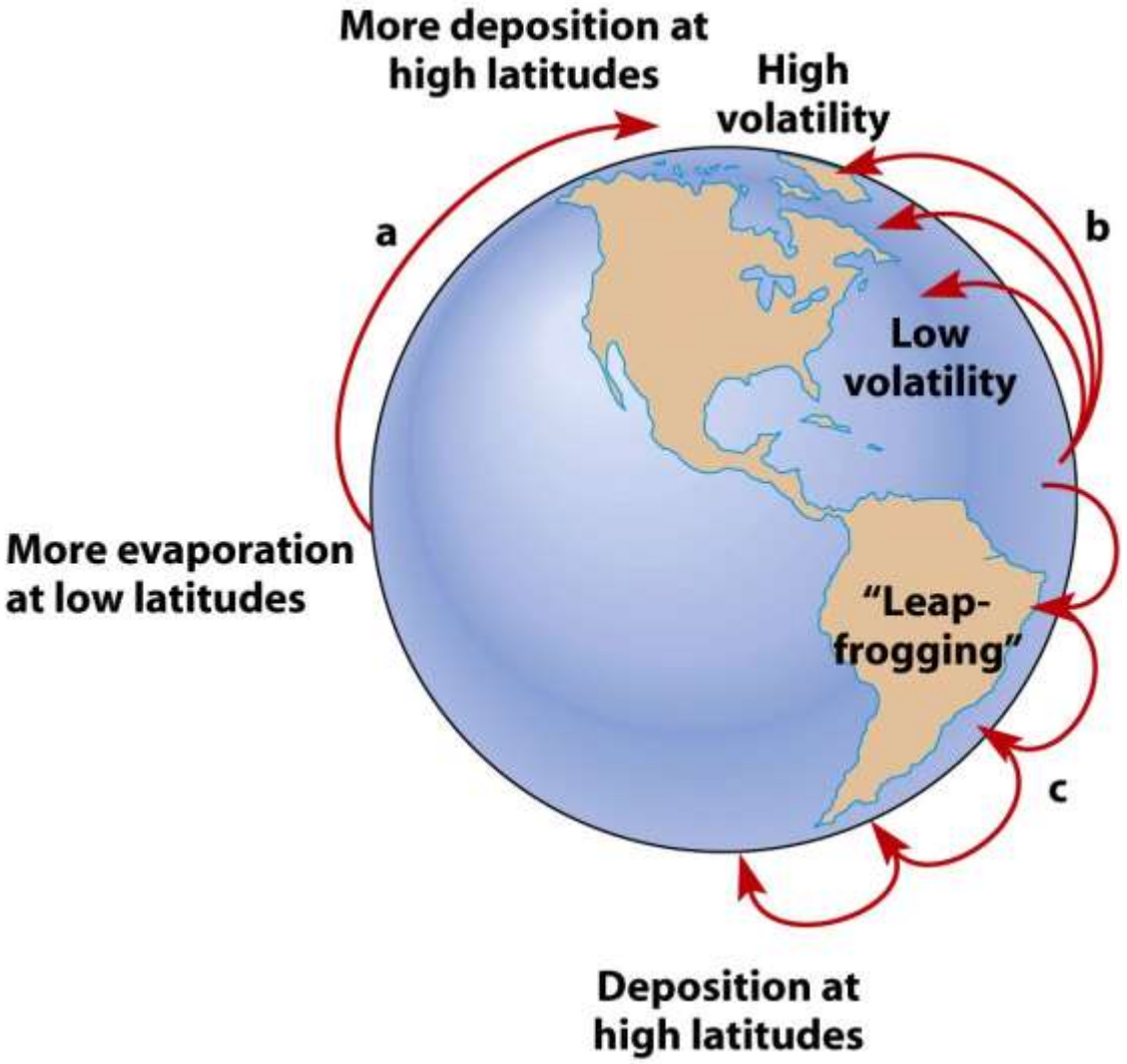
Agricultural Effects of Air pollution

- 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).

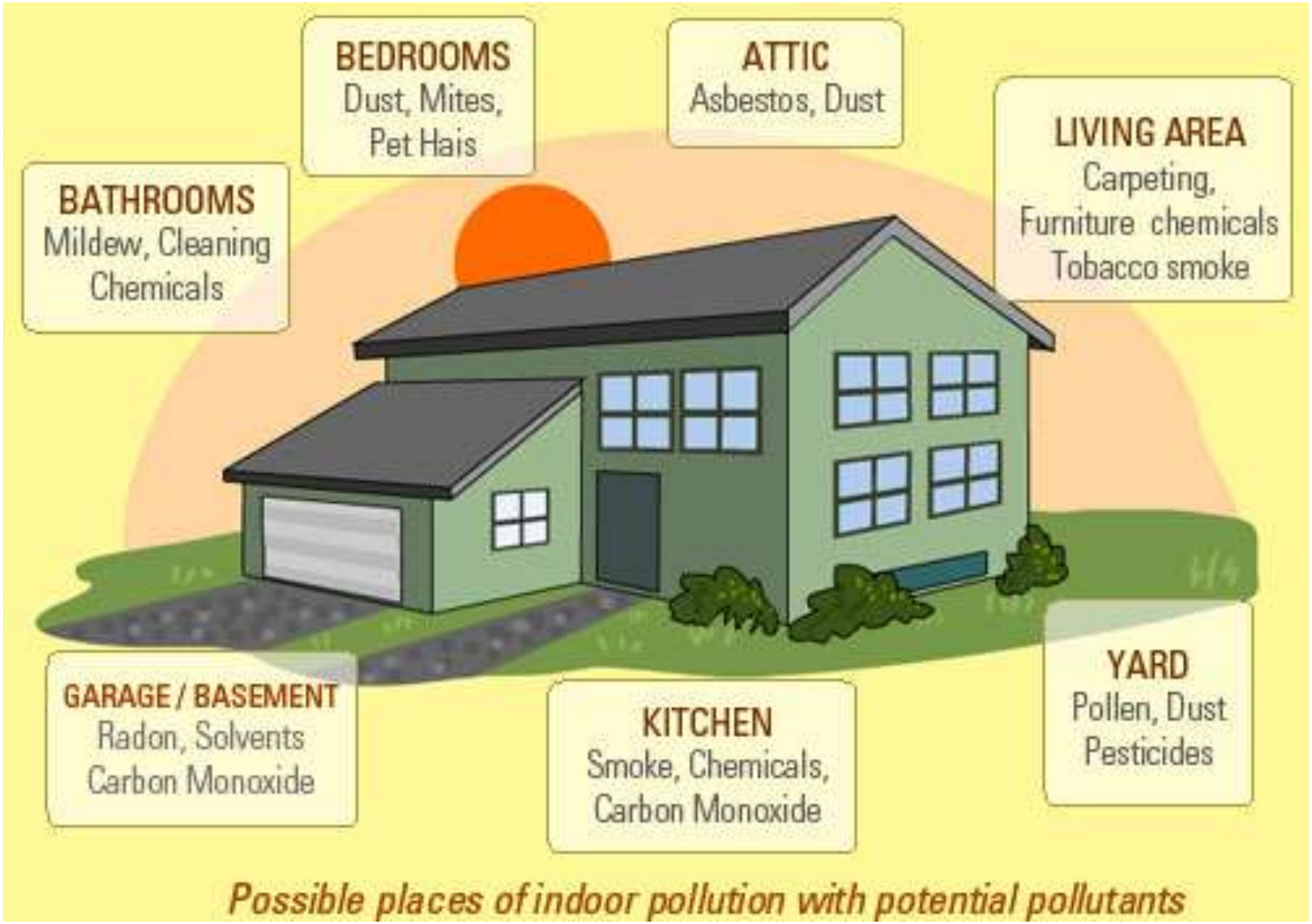
Air Pollution Around the World

- Air quality is deteriorating rapidly 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

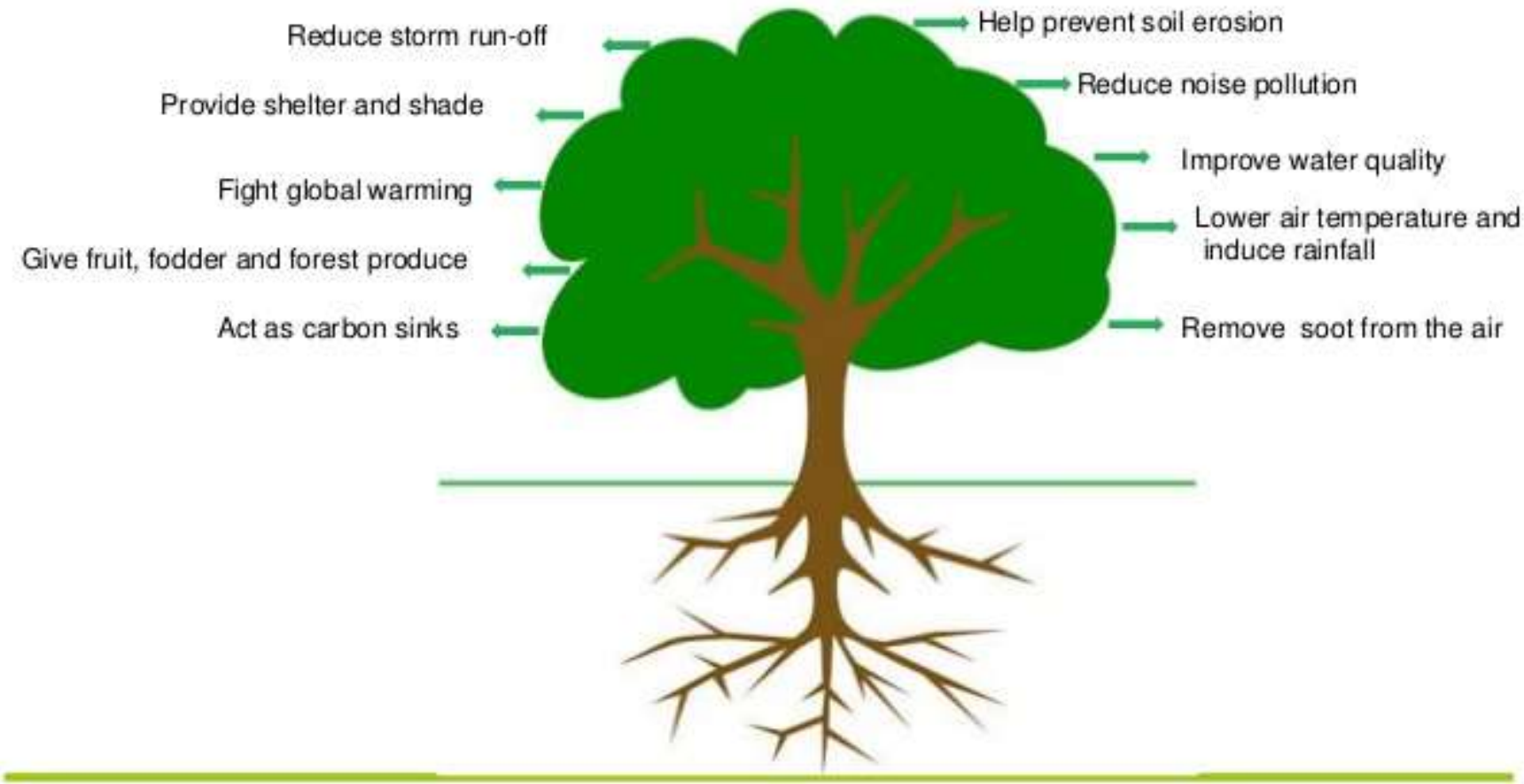
Common indoor air pollutants include:

- **Tobacco smoke:** This is smoke burning cigarettes 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 ventilation.

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

Occupational Health

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Why is occupational health and safety important?

- Work plays a central role in people's lives, since most workers spend at least eight hours a day in the workplace, whether it is in an office or in the factory, etc.
- Workers represent half the world’s population (3.5 billion) and are the major contributors to economic and social development.
- Therefore, work environments should be safe and healthy. Yet this is not the case for many workers.
- Every day workers all over the world are faced with a multitude of health hazards, such as: dusts; gases; noise; vibration; & extreme temperatures.

So, what is the problem with occupational health?

- The health of workers is an essential prerequisite for household income, productivity and economic development. Therefore, restoring and maintaining working capacity is an important function of the health services.
- Unfortunately some employers assume little responsibility for the protection of workers' health and safety.
- In fact, some employers do not even know that they have the moral and often legal responsibility to protect workers.
- As a result of the hazards and a lack of attention given to health and safety, work-related accidents and diseases are common in all parts of the world.

Why is occupational health and safety important?

- In many countries more than half of workers are employed in the informal sector, with no social protection for seeking health care and lack of regulatory enforcement of occupational health and safety standards.
- Occupational health services cover mostly big companies in the formal sector. But, more than 85% of workers in small workplaces, informal sector, agriculture and migrants worldwide, do not have any occupational health coverage.
- Research has demonstrated that workplace health initiatives can help reduce sick leave absenteeism by 27% and health-care costs for companies by 26%.

https://www.who.int/en/news-room/fact-sheets/detail/protecting-workers'-health

Why is occupational health and safety important?

- The ILO and WHO also estimate that globally, more than 2 million people die every year from work related diseases and injuries.
- 4-6% GDP id lost due to illnesses and injuries due to unhealthy and hazardous working conditions
- About 70% of workers do not have any insurance to compensate them in case of occupational diseases and injuries.

https://www.who.int/en/news-room/fact-sheets/detail/protecting-workers'-health

Why is occupational health and safety important?

Certain occupational risks, such as injuries, noise, carcinogenic agents, airborne particles and ergonomic risks account for a substantial part of the burden of **chronic diseases**:

37% of all cases of **back pain**

16% of **hearing loss**

13% of **chronic obstructive pulmonary disease**

11% of **asthma**

9% of **lung cancer**

8% of **injuries**

8% of **depression**

2% of **leukaemia**

https://www.who.int/en/news-room/fact-sheets/detail/protecting-workers'-health

Definition of Occupational Health:

Since 1950, the International Labour Organization (ILO) and the World Health Organization (WHO) have shared a common definition of occupational health.

Occupational Health is the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations by preventing departures from health, controlling risks and the adaptation of work to people, and people to their jobs.
(ILO / WHO 1950)

The science and practice of occupational health **involves several disciplines**, such as occupational medicine, nursing, ergonomics, psychology, hygiene, safety among other desciplines.

Occupational Health, History

- The first written discussions specifically directed toward matters of occupational safety and health were those of **Paracelsus**, in the fifteenth century.
- In 1700, **Bernadino Ramazzini**, an Italian physician, published the first book on occupational medicine, *De morbis artificium diatribe (**Diseases of Workers**)*, and he is generally regarded as the "father of occupational medicine." Ramazzini wrote about the health hazards for dozens of occupations.

Occupational Health, History

- In the United States, in the early twentieth century, Dr. Alice Hamilton became the first woman physician appointed to a faculty position at Harvard University, where she worked at the School of Public Health promoting safe and healthful work practices in the United States.
- She has been recognized as the leader of the occupational medicine movement in the United States, which came relatively late compared with that in Europe.

Identifying Safety and Health Hazards

The terminology used in Occupational Safety and Health (OSH) varies, but generally speaking:

- **A hazard is something that can cause harm if not controlled.**
- **The outcome is the harm that results from an uncontrolled hazard.**
- **A risk is a combination of the *probability* that a particular outcome will occur and the *severity* of the harm involved.**

The calculation of risk is based on the likelihood or probability of the harm being realized and the severity of the consequences.

Identifying Safety and Health Hazards, example

For example, repetitively carrying out manual handling of heavy objects is a **hazard**.

The **outcome** could be a musculoskeletal disorder (MSD) or an acute back or joint injury.

The **risk** can be expressed numerically (e.g. 0.5 or 50% or 50/50 chance of the outcome occurring during a year) OR in relative terms can be expressed as (e.g. "high/medium/low“ risk of developing outcome during a certain time period).

Common workplace hazard groups

1- Mechanical hazards.

By type of agent:

- Falling down from a height (construction workers)
- Confined Space
- Impact force
- Slips and trips
- Falling on a pointed object
- Compressed air/high pressure
- Entanglement
- Equipment-related injury

By type of damage:

Crushing, Cutting, Friction and abrasion, Shearing , Stabbing and puncture

2. physical hazards .

- Noise
- Vibration
- Barotrauma (hypobaric/hyperbaric pressure)
- Ionizing radiation
- Electricity
- Asphyxiation
- Cold stress (hypothermia)
- Heat stress (hyperthermia)

3- Biological Hazards:

Bacteria

Virus

Fungi

e.g. Blood-borne pathogens

e.g. Tuberculosis

4- Chemical hazards

include:

Acids

Bases

Heavy metals

Solvents

Particulates: **Fumes (noxious gases/vapors), silica particles (pneumoconiosis)**

Highly-reactive chemicals

Fire, explosion hazards.

Pneumoconiosis

- Pneumoconiosis has been the most serious and preventable occupational disease for a long time…where inhalation of dust has caused interstitial fibrosis because of Inadequate use of personal protective equipment (PPE).
- The most common workplace mineral dusts that are known to cause pneumoconiosis are asbestos, silica (rock and sand dust), and coal dust.
- In China, the number of workers exposed to silica containing dusts was estimated to be as high as 12 million .
- Pneumoconiosis represents 70–80% of the total number of cases of reported occupational diseases in mining industry, sand blasting, textile industry, and ship repair.

5- Psychosocial issues include

- Work-related stress, whose causal factors include excessive working time and overwork .
- Violence from outside the organization .
- Bullying, which may include emotional and verbal abuse (inside the organization)
- Sexual harassment
- Burnout
- Exposure to unhealthy elements during meetings with business associates, e.g. tobacco, uncontrolled alcohol

Psychosocial hazards

In 1986, the National Institute for Occupational Safety and Health (NIOSH) listed **psychological disorders** among the **ten leading work-related diseases** and injuries among U.S. workers.

Psychosocial hazards, however, have received little attention over the past decades. This is mainly because of the focus on controlling physical, chemical and biological hazards in workplaces.

6. Musculoskeletal Disorders

Musculoskeletal diseases are a major industrial problem in terms of both disability and cost.

- These diseases cause a large number of permanent disability ratings and a burden to medical services.
- Low back pain occurs in 50% of workers in heavy industries.
- Repetitive loadings appear to fatigue and weakens the tissues.
- Avoided by the employment of good ergonomic design
- The need to reduce musculoskeletal injuries in the workplace has become acute.

Occupational Health in Health Workers

A health care facility is a workplace as well as a place for receiving and giving care. Health care facilities around the world employ over 59 million workers, who are exposed to a complex variety of health and safety hazards everyday, including:

- biological hazards, such as TB, Hepatitis, HIV/AIDS, SARS, covid 19
- chemical hazards, such as, glutaraldehyde, ethylene oxide
- physical hazards, such as noise, radiation, slips trips and falls
- ergonomic hazards, such as heavy lifting
- psychosocial hazards, such as shiftwork, violence and stress
- fire and explosion hazards, such as using oxygen, alcohol sanitizing gels
- electrical hazards, such as frayed electrical cords.

Occupational Health Hazards among Doctors and Nurses

Infectious Diseases: Tuberculosis: Common among health care workers, Hepatitis B, Hepatitis C, HIV, Influenza,

Risks related to stress and overwork: Depression, suicide, hopelessness, Burnout, Restricted social life, prone to alcohol/ drug abuse/ drug exposure.

Stress of balancing Family life: Kind of work and night duties effect family life very adversely, Specially female doctors. Completing family will affect their careers, most of time. High rates of divorces, Stress related diseases.

Life style diseases: mainly sedentary work and long hours of working, makes them prone to life style diseases like ischemic heart disease , hypertension etc.

Exposure to radiations: specially in radiology and oncology. female doctors are more affected.

Lack of exposure to sunlight: affects bones , deficiency of vitamin D and predisposes to depression.

Occupational Health Hazards among Doctors and Nurses

Risk of catching resistant infections and sometimes there is risk that they carry these deadly bacteria to their homes. So their family members and children are at risk.

Risk of working in disaster areas, floods, earthquakes.

C**hange in natural bio flora of doctors and nurses**. It is replaced by hospital bio flora. If they get infection, it is difficult to treat.

Risks because of legal problems and violent patients:

Legal trouble adds to further stress.

Verbal abuse and threatening is very common.

Fear of physical assault can really harm doctors and family members.

Excessive and unilateral regulation puts doctors at the receiving end of the discontent (doctors always blamed).