Air pollution is the contamination of the indoor or ambient air by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere.

Pollutants of major public health concern include particulate matter (PM10, PM2.5), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide.

Ambient particulate matter was designated by International Agency for Research on Cancer (IARC) as a Group I carcinogen based on evidence of the relationship between PM2.5 or PM10 and lung cancer.

In the Low and Middle Income Countries (LMIC) of the Western Pacific Region, about 1.62 million deaths were attributed to household air pollution (HAP) and about 1.67 million to ambient air pollution in 2012.

Premature deaths and burden of disease from cardiovascular and respiratory diseases can be decreased by reducing air pollution levels and improving air quality.

PM2.5 is a mass concentration of particles smaller than 2.5 micrometers in diameter and can lodge deeply into the lungs. Sometimes referred to as "fine" particles, they pose the greatest health risks because of their small size which is approximately 1/30th the average width of a human hair.

The WHO air quality guidelines are designed to offer guidance in reducing the health impacts of air pollution.

Policies and investments supporting cleaner transport, energy-efficient housing, power generation, industry, and proper waste management will reduce urban ambient air pollution.

WHO is advocating the provision of cleaner fuel and efficient heating and cooking stoves to reduce indoor air pollution.
Introduction

- Air quality is a problem both indoors and outdoors.
- Air pollution causes respiratory conditions and other diseases which have significant impact on health.
- Air pollutants of major public health concern include particulate matter, ozone, nitrogen oxide, sulfur dioxide and carbon monoxide.
- Emissions from energy production, motorized transportation, patterns of industrial and urban development contribute to problems with ambient air quality causing approximately 3.7 million premature deaths per year worldwide.
- Problems with indoor air quality stem from use of unsafe fuel such as excreta, wood, and coal which emits fumes causing approximately 4.3 million premature deaths worldwide.
- The world’s annual average concentration of PM10 for 2012 (71 µg/m³) is higher than the WHO acceptable value (20 µg/m³). The average for LMIC in the Western Pacific (87 µg/m³) is higher than the world average and WHO acceptable values.
- Ozone is formed in the lower atmosphere from gaseous precursors, largely from pollutants caused by human activities. It can trigger asthma, reduce lung function and cause lung diseases.
- Nitrogen dioxide is one of the gases that belong to a highly reactive family of gases called as nitrogen oxides (NOx). Principal sources include motor vehicle exhausts, heaters and power generators. It is an irritant which can cause inflammation in the airways and low resistance to infections.
- Sulfur dioxide is a colorless gas with a sharp odor produced from the burning of fossil fuels and the smelting of mineral ores that contain sulfur. It can affect respiratory function and causes irritation of the eyes. Sulfuric acid is formed when sulfur dioxide is combined with water. It is the main component of acid rain which causes deforestation and loss of fish in acid sensitive lakes and streams.
- Carbon monoxide is a colorless and odorless gas which arises from inefficient and incomplete combustion of fuels. It causes deoxygenation of vital organs in the body which at extreme levels causes death. It is usually linked to urbanization, crowding, use of fossil fuel and traffic congestion.

Indoor Air Quality and Health

- Air pollution from household fuel combustion is an important global environmental health risk claiming one life every 20 seconds in developing countries.
- It is estimated that around 36,000 lung cancer deaths yearly could be avoided by providing cleaner stoves.
- Almost 3 billion of the world’s poorest people use wood, animal dung, charcoal, crop wastes and coal as solid fuels burned in inefficient and highly polluting stoves for cooking and heating which produces high levels of indoor air pollutants such as fine particles and carbon monoxide.
- Inefficient cooking methods and poor ventilation coupled with the use of solid fuels can elevate the concentration of indoor air pollutants, increasing exposure up to a hundred fold. (7)
- The use of solid fuel for heating is also prevalent in developed countries and contributes significantly to ambient air pollution.

Ambient Air Quality and Health

- In 2012, ambient air pollution was estimated to cause about 3.7 million deaths globally. Majority of these deaths came from the LMIC in the Western Pacific with about 1.67 million deaths.
- Ambient air pollution is also linked to increased incidence of asthma attacks leading to significant absenteeism and loss of productivity.
WHO has published “Air Quality Guidelines” which recommend exposure limits for key air pollutants.

To decrease indoor air pollution, WHO is evaluating new cooking technologies. WHO is also providing technical support to countries in their own evaluations and scale-up of health-promoting stove technologies. Together with the Global Alliance for Clean Cook stoves, WHO is promoting improved biomass cook stove designs to reduce indoor air pollution.

WHO is providing new indoor air quality guidelines for fuel combustion through health-based recommendations on fuels, stoves and strategies for effective dissemination of safer cooking technologies to ensure healthy air in and around households.

WHO monitors global progress in the transition to cleaner fuel and improved stoves through the WHO Household Energy Database. This database includes information on disease burden and energy access situation from member states.

WHO’s “Health in the Green Economy” series assess the health co-benefits of climate mitigation and energy efficient measures that reduce air pollution from housing, transport, and other key economic sectors.

WHO’s work on “Measuring Health Gains from Sustainable Development” has proposed air pollution indicators as a marker of progress on development goals related to sustainable development in cities and the energy sector.

WHO supports the efforts to decrease indoor air pollution since it is beneficial in eradicating extreme poverty and hunger, promoting gender equality and empowering women, reducing child mortality, improving maternal health, and in ensuring environmental sustainability.

Healthy Air

WHO Recommendations

To Improve Indoor Air Quality

- Emission rates from household fuel combustion should not exceed the WHO Indoor Air Quality Guidelines for household fuel combustion targets for PM2.5 and carbon monoxide (CO) based on the values for kitchen volume, air exchange and duration of device use per day and which are assumed to be representative of conditions in LMICs.

- Separate recommendations are provided for vented and unvented stoves. Vented stoves are those technologies with chimneys or other venting mechanisms that can improve indoor air quality through moving a fraction of the pollutants outdoors:
  - PM$_{2.5}$ (unvented): 0.23 (mg/min)
  - PM$_{2.5}$ (vented): 0.80 (mg/min)
  - CO (unvented): 0.16 (g/min)
  - CO (vented): 0.59 (g/min)

- Governments and their implementing partners should develop strategies to accelerate efforts to meet these air quality guidelines and emission rate targets.

- Unprocessed coal that has not been treated by chemical, physical or thermal means to reduce contaminants should not be used as a household fuel.

- The household use of kerosene is discouraged and further research into its health impacts is being conducted.

To Improve Ambient Air Quality

- WHO recognizes that most sources of ambient air pollution are well beyond the control of individuals and requires action by private companies, industries, cities, as well as government agencies and policy makers.

- The Air Quality Guidelines include recommended levels of air pollutants which facilitate policy directions to member states:
  - PM$_{2.5}$: 10 µg/m$^3$ annual mean, 25 µg/m$^3$ 24-hour mean
  - PM$_{10}$: 20 µg/m$^3$ annual mean, 50 µg/m$^3$ 24-hour mean
  - NO$_2$: 1 µg/m$^3$ 8-hour mean
  - NO$_x$: µg/m$^3$ annual mean, 200 µg/m$^3$ 1-hour mean
  - SO$_2$: 20 µg/m$^3$ 24-hour mean, 500 µg/m$^3$ 10-minute mean

- WHO recommends learning from the many examples of successful policies in various sectors including transport, urban planning, power generation and industries that reduce air pollution.
References