World Health Organization

Media centre

Air quality and health

Share Print

Fact sheet N°313
Updated September 2011

Key facts

- Air pollution is a major environmental risk to health. By reducing air pollution levels, we can help countries reduce the global burden of disease from respiratory infections, heart disease, and lung cancer.
- The lower the levels of air pollution in a city, the better respiratory (both long- and short-term), and cardiovascular health of the population will be.
- Indoor air pollution is estimated to cause approximately 2 million premature deaths mostly in developing countries. Almost half of these deaths are due to pneumonia in children under 5 years of age.
- Urban outdoor air pollution is estimated to cause 1.3 million deaths worldwide per year. Those living in middle-income countries disproportionately experience this burden.
- Exposure to air pollutants is largely beyond the control of individuals and requires action by public authorities at the national, regional and even international levels
- The *WHO Air quality guidelines* represent the most widely agreed and up-to-date assessment of health effects of air pollution, recommending targets for air quality at which the health risks are significantly reduced. The Guidelines indicate that by reducing particulate matter (PM10) pollution from 70 to 20 micrograms per cubic metre, we can cut air quality related deaths by around 15%.

Background

Air pollution, both indoors and outdoors, is a major environmental health problem affecting everyone in developed and developing countries alike. The 2005 *WHO Air quality guidelines* (AQGs) are designed to offer global guidance on reducing the health impacts of air pollution. The guidelines first produced in 1987[1] and updated in 1997[2] had a European scope. The new (2005) guidelines apply worldwide and are based on expert evaluation of current scientific evidence. They recommend revised limits for the concentration of selected air pollutants: particulate matter (PM), ozone (O3), nitrogen dioxide (NO2) and sulfur dioxide (SO2), applicable across all WHO regions.

For more information contact:

WHO Media centre
Telephone: +41 22 791 2222
E-mail: mediainquiries@who.int

Related links

Air quality guidelines - global update 2005

Key findings in 2005 Air Quality Guidelines are as follows.

- There are serious risks to health from exposure to PM and O3 in many cities of developed and developing countries. It is possible to derive a quantitative relationship between the pollution levels and specific health outcomes (increased mortality or morbidity). This allows invaluable insights into the health improvements that could be expected if air pollution is reduced.
- Even relatively low concentrations of air pollutants have been related to a range of adverse health effects.
- Poor indoor air quality may pose a risk to the health of over half of the world's population. In homes where biomass fuels and coal are used for cooking and heating, PM levels may be 10–50 times higher than the guideline values.
- Significant reduction of exposure to air pollution can be achieved through lowering the concentrations of several of the most common air pollutants emitted during the combustion of fossil fuels. Such measures will also reduce greenhouse gases and contribute to the mitigation of global warming.

In addition to guideline values, the AQGs give interim targets related to outdoor air pollution, for each air pollutant, aimed at promoting a gradual shift from high to lower concentrations. If these targets were to be achieved, significant reductions in risks for acute and chronic health effects from air pollution can be expected. Progress towards the guideline values, however, should be the ultimate objective.

Particulate matter

Guideline values

$PM_{2.5}$
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

The 2005 AQG set for the first time a guideline value for particulate matter (PM). The aim is to achieve the lowest concentrations possible. As no threshold for PM has been identified below which no damage to health is observed, the recommended value should represent an acceptable and achievable objective to minimize health effects in the context of local constraints, capabilities and public health priorities.

Definition and principle sources
PM affects more people than any other pollutant. The major components of PM are sulfate, nitrates, ammonia, sodium chloride, carbon, mineral dust and water. It consists of a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air. The particles are identified according to their aerodynamic diameter, as either PM_{10} (particles with an aerodynamic diameter smaller than 10 μm) or $PM_{2.5}$ (aerodynamic diameter smaller than 2.5 μm). The latter are more dangerous since, when inhaled, they may reach the peripheral regions of

the bronchioles, and interfere with gas exchange inside the lungs.

Health effects

The effects of PM on health occur at levels of exposure currently being experienced by most urban and rural populations in both developed and developing countries. Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases, as well as of lung cancer. In developing countries, exposure to pollutants from indoor combustion of solid fuels on open fires or traditional stoves increases the risk of acute lower respiratory infections and associated mortality among young children; indoor air pollution from solid fuel use is also a major risk factor for chronic obstructive pulmonary disease and lung cancer among adults. The mortality in cities with high levels of pollution exceeds that observed in relatively cleaner cities by 15–20%. Even in the EU, average life expectancy is 8.6 months lower due to exposure to $PM_{2.5}$ produced by human activities.

Ozone (O_3)

Guideline values

O_3

100 µg/m^3 8-hour mean

The previously recommended limit, which was fixed at 120 µg/m^3 8-hour mean, has been reduced to 100 µg/m^3 based on recent conclusive associations between daily mortality and ozone levels occurring at ozone concentrations below 120 µg/m^3.

Definition and principal sources

Ozone at ground level – not to be confused with the ozone layer in the upper atmosphere – is one of the major constituents of photochemical smog. It is formed by the reaction with sunlight (photochemical reaction) of pollutants such as nitrogen oxides (NO_x) from vehicle and industry emissions and volatile organic compounds (VOCs) emitted by vehicles, solvents and industry. The highest levels of ozone pollution occur during periods of sunny weather.

Health effects

Excessive ozone in the air can have a marked effect on human health. It can cause breathing problems, trigger asthma, reduce lung function and cause lung diseases. In Europe it is currently one of the air pollutants of most concern. Several European studies have reported that the daily mortality rises by 0.3% and that for heart diseases by 0.4 %, per 10 µg/m^3 increase in ozone exposure.

Nitrogen dioxide (NO_2)

Guideline values

NO_2

40 µg/m^3 annual mean

200 µg/m^3 1-hour mean

The current WHO guideline value of 40 µg/m^3 (annual mean) set to protect the public from the health effects of gaseous NO_2 remains unchanged from the level recommended in the previous AQGs.

Definition and principle sources
As an air pollutant, NO_2 has several correlated activities.

- At short-term concentrations exceeding 200 µg/m^3, it is a toxic gas which causes significant inflammation of the airways.
- NO_2 is the main source of nitrate aerosols, which form an important fraction of $PM_{2.5}$ and, in the presence of ultraviolet light, of ozone.

The major sources of anthropogenic emissions of NO_2 are combustion processes (heating, power generation, and engines in vehicles and ships).

Health effects
Epidemiological studies have shown that symptoms of bronchitis in asthmatic children increase in association with long-term exposure to NO_2. Reduced lung function growth is also linked to NO_2 at concentrations currently measured (or observed) in cities of Europe and North America.

Sulfur dioxide (SO_2)

Guideline values

SO_2
20 µg/m^3 24-hour mean
500 µg/m^3 10-minute mean

A SO_2 concentration of 500 µg/m^3 should not be exceeded over average periods of 10 minutes duration. Studies indicate that a proportion of people with asthma experience changes in pulmonary function and respiratory symptoms after periods of exposure to SO_2 as short as 10 minutes.

The revision of the 24-hour guideline for SO_2 from 125 to 20 µg/m^3 is based on the following considerations.

- Health effects are now known to be associated with much lower levels of SO_2 than previously believed.
- A greater degree of protection is needed.
- Although the causality of the effects of low concentrations of SO_2 is still uncertain, reducing SO_2 concentrations is likely to decrease exposure to co-pollutants.

Definition and principal sources
SO_2 is a colourless gas with a sharp odour. It is produced from the burning of fossil fuels (coal and oil) and the smelting of mineral ores that contain sulfur. The main anthropogenic source of SO_2 is the burning of sulfur-containing fossil fuels for domestic heating, power generation and motor vehicles.

Health effects

SO_2 can affect the respiratory system and the functions of the lungs, and causes irritation of the eyes. Inflammation of the respiratory tract causes coughing, mucus secretion, aggravation of asthma and chronic bronchitis and makes people more prone to infections of the respiratory tract. Hospital admissions for cardiac disease and mortality increase on days with higher SO_2 levels. When SO_2 combines with water, it forms sulfuric acid; this is the main component of acid rain which is a cause of deforestation.

WHO will assist the Member States in sharing information on successful approaches, on methods of exposure assessment and monitoring of health impacts of pollution.

[1] *Air quality guidelines for Europe. Copenhagen, World Health Organization Regional Office for Europe, 1987 (WHO Regional Publications, European Series, No. 23).*
[2] *Air quality guidelines for Europe, 2nd ed. Copenhagen, World Health Organization Regional Office for Europe, 2000 (WHO Regional Publications, European Series, No. 91).*