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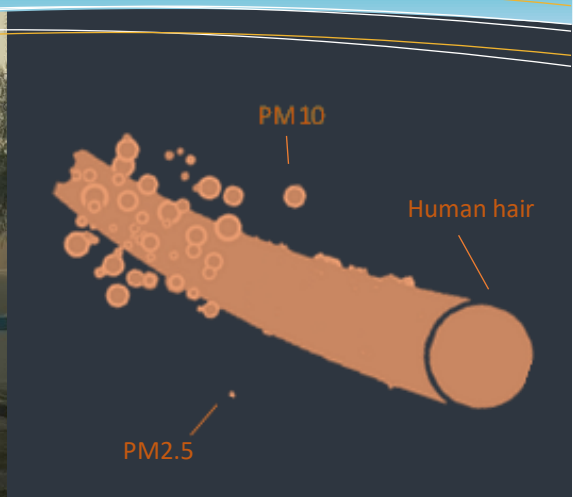
Poison of the month



Primary / secondary particulate matter

As with air pollutants, a distinction is made between two types of particulate matter, depending on their origin:

Primary particulate matter is released directly into the air from natural or anthropogenic sources. These include soot particles from combustion processes (e.g. diesel exhaust fumes, wood stoves), dust from construction sites, agricultural emissions or volcanic ash. These particles are present in the air from the outset and can be inhaled immediately.

Secondary particulate matter, on the other hand, is only formed through chemical reactions in the atmosphere. Gaseous pollutants such as sulphur dioxide (SO_2), nitrogen oxides (NO_x) or ammonia (NH_3) react with other air components and condense into solid or liquid particles. These secondary aerosols are often particularly small and can penetrate deep into the lungs. Ozone, another dangerous pollutant gas, is produced secondarily by chemical reactions of nitrogen oxides, among other things, under solar radiation.

PM2.5 and PM0.1 in particular consist to a large extent of secondary particles, while PM10 is often of a more primary nature.

The role of the atmosphere

The air quality at a location is influenced by several factors. For example, local emissions from traffic, industry and agriculture release pollutants directly into the atmosphere. These pollutants are then transported further by transmission, with wind and weather determining their dispersion. In the air, many of these substances undergo chemical processes in which they are either converted into new compounds or broken down. An important mechanism for cleaning the air is deposition, in which pollutants are washed out by rain or bound to surfaces by dry deposition. However, there is always a back-

Air pollution and health: an underestimated danger

At the beginning of February 2025, warnings were issued in various areas in Germany, but also in other parts of Europe, about adverse health effects caused by polluted air.

Despite significant progress in air pollution control, air pollution remains one of Europe's most pressing environmental problems. The European Environment Agency (EEA) estimates that at least 238,000 people in the EU die prematurely every year because they are exposed to excessive levels of polluted air.

The air quality in a place depends on various factors. Not only the amount of pollutants released and the type of pollutants play a decisive role, but also the weather. The reason for the current high levels of pollution was the persistent inversion weather conditions, in which cold layers of air accumulate on the ground, preventing pollutants from escaping into the atmosphere. In many places, this was linked to the lack of cleansing precipitation, which can wash pollutants out of the air.

Fine dust particles can penetrate deep into the respiratory tract. Depending on the particle size, particulate matter is divided into different categories, which differ in terms of their formation and health effects. PM10 includes particles with a diameter of up to 10 micrometers (µm), which are released by mechanical processes such as tire abrasion or construction site dust. However, the heating of residential buildings and commercial and institutional energy consumption also account for almost half of the pollution with this coarse-grained particulate matter. These relatively coarse particles enter the paranasal sinuses and upper respiratory tract (bronchi), where they can cause irritation, inflammation and respiratory diseases.

Finer particles with a maximum diameter of 2.5 µm are referred to as

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ground level of pollution - a basic concentration of pollutants caused by global emissions, long-distance transport and natural sources.

If these factors interact unfavourably, pollutants can accumulate in the atmosphere and lead to significant health and environmental impacts.

Guideline and limit values

There is no safe threshold value for exposure to particulate matter. The World Health Organization (WHO) has set guideline values of 5 µg/m3 for PM2.5 and 15 µg/m3 for PM10. According to the WHO, 97% of the urban population was still exposed to concentrations above the WHO guideline values in 2021. EU limit values for PM10 particulate matter have been in place since 2005. The daily limit value for PM10 is 50 µg/m3 and must not be exceeded more than 35 times a year. The annual average value is 40 µg/m3. A binding annual limit value of 25 µg/m3 has been in place for PM2.5 since 2015. However, these values are significantly higher than the WHO recommendations.

Necessary changes

In order to sustainably reduce particulate matter pollution, comprehensive measures are required in various areas of our economic and social life. The promotion of emission-free mobility and stricter exhaust emission standards in the mobility sector are at the forefront of this. The EU's decision to phase out combustion engines is the right decision in this context. Due to the poor economic situation, some member states, first and foremost Germany, are now trying to delay the implementation of this goal, putting short-term economic interests above health. In an open letter, more than 500 doctors, including the President of the German Medical Association, Klaus Reinhardt, are now calling on EU Commission President Ursula von der Leyen to stick to the planned phase-out, as air pollution is the greatest environmental health risk, threatening the lives of EU citizens.

PM2.5. They are mainly produced by combustion processes in industry, traffic or heating systems, which account for 58% of PM2.5 pollution. Due to their smaller size, they penetrate deeper into the lungs, reach alveoli and can enter the bloodstream. There they promote systemic inflammation, oxidative stress and cardiovascular disease.

Even smaller are ultrafine particles (PM0.1), which have a diameter of less than 0.1 µm. They are produced in particular by combustion engines and industrial processes. Their tiny size allows them to pass through the lung barrier and enter the bloodstream, where they can reach organs such as the heart or brain. Due to their chemical composition and surface structure, they are considered particularly toxic and are suspected of causing neurological damage, DNA damage and inflammatory processes throughout the body. Long-term exposure to particulate matter can promote chronic diseases such as cancer, COPD and cardiovascular diseases. In addition, a link has been shown between increased PM0.1 pollution and the increased incidence of type 2 diabetes.

Children, the elderly and people with chronic respiratory diseases are particularly at risk from particulate matter. Even short-term exposure can lead to critical situations.

The EU is pursuing a zero-pollution target by 2050, which will require a drastic reduction in emissions and the implementation of ambitious environmental legislation. This is viewed critically by many interest groups, but is essential to better protect people's health from air pollution and counteract the climate crisis.

By Ute Haßmann

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