

# Health damage caused by fine particulate matter

**Fine particulate matter causes much more severe health damage than previously assumed. Austria needs more monitoring sites, stricter limits, and effective traffic measures.**

The smaller the particles, the more dangerous they are to our health. Ultrafine particles can cause lung damage, cancer, and heart attacks, and stunt the physical development of children. The World Health Organisation (WHO) recommends a threshold for fine particulate matter (PM<sub>2.5</sub>) of 10 µg per cubic metre of air. In those Austrian provincial capitals where PM<sub>2.5</sub> is monitored, this level has lately been exceeded considerably, and from 2015 on, the EU threshold for PM<sub>2.5</sub> will be twice the recommended WHO level at 20 µg/m<sup>3</sup> of air. Even the US has a stricter limit for PM<sub>2.5</sub> particulate matter at 12 µg/m<sup>3</sup> of air.

## Transportation is the main source of carcinogenic particulate matter in cities

More than half of Austria's population lives in cities and metropolitan areas. Traffic is the main source of fine particulate matter in cities, especially along busy roads. Diesel cars without particulate filters are especially heavy polluters. Whenever we are stuck in a traffic jam or walk along a busy road, we are surrounded by a cloud of noxious fumes. Measures must be implemented quickly to protect the population's health. In addition to the expansion of public transport services, low emission zones and congestion charges are also very effective in improving air quality in metropolitan areas.

# Fine particulate matter is a major health risk



## Not enough monitoring locations:

Austria needs more monitoring locations and stricter limits for the extremely harmful PM2.5.

The health effects of fine particulate matter in the PM2.5 to PM0.1 range were underestimated for a long time. Even today, a few lobbyists remain who try to play down the damage caused to health by particulate matter. Numerous studies provide evidence that fine particulate matter, in particular, is severely harmful to health. Studies have shown an increase in lung cancer caused by chronic exposure to PM2.5. In Vienna, the daily number of hospital patients admitted for respiratory disorders increased by 5.5% for each 10 µg increment of PM2.5 per cubic metre. On days with high particulate matter levels, the number of hospital admittances increases by up to 20%.

## Lung damage, arteriosclerosis, and dementia

The most recent WHO study shows that excessive exposure to PM2.5 can cause arteriosclerosis, premature births, and respiratory diseases in children. Particulate matter exposure may also be connected to neurological development and cognitive skills as well as diabetes. A Californian study draws a connection between autism and exposure to nitrogen

## Excessive exposure:

PM2.5 levels in Austria are considerably above the recommended WHO limit.

oxide, PM2.5, and PM10 during pregnancy and the first year of life. There is also evidence suggesting that it may contribute to the development of dementia and Alzheimer's disease.

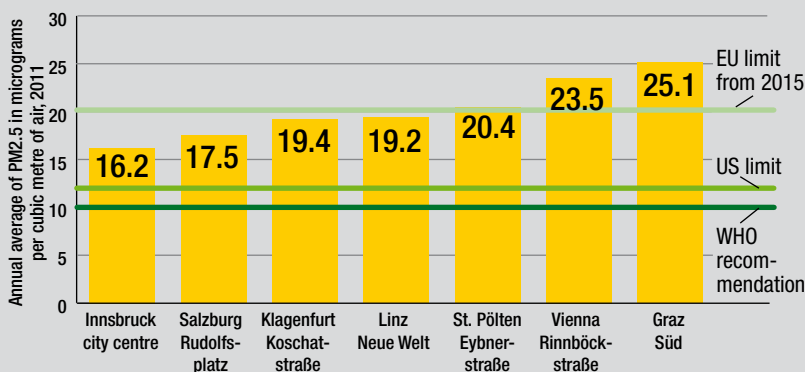
## From the exhaust pipe to our brains

The slightly coarser particulate matter (PM10) is deposited in the nose, the throat, and the bronchial tubes. Fine particulate matter (PM2.5) enters the bronchial tubes, and ultrafine particles (PM0.1) even reach the alveoli and enter the bloodstream. They can increase blood clotting, heightening the risk of heart attack and stroke. Once they have entered the bloodstream, ultrafine particles can also be transported to other organs, such as the liver, the kidneys, the brain, and the heart. No threshold has been identified for these ultrafine particles below which no damage to health is observed. Studies have described increased rates of birth deformities and premature births in regions with high levels of these particles. Children, elderly people, and people suf-

## Transportation is the main cause:

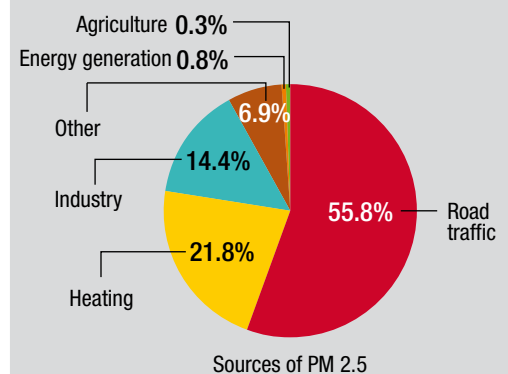
In cities, such as Vienna, road traffic is the main source of harmful PM2.5 particles.

## Levels of dangerous fine particulate matter in Austria higher than WHO recommendations



Source: Environment Agency Austria. Graphics: VCO 2013

## Road traffic causes majority of PM2.5 in Vienna



Source: ELBA 2010, Puxbaum 2011. Graphics: VCO 2013



fering from cardiac diseases or diabetes are especially affected by ultrafine particles.

### Carcinogenic diesel exhaust fumes

Many people in metropolitan areas live near busy roads, where there are high concentrations of ultrafine particulate matter caused mainly by road traffic. The main sources are the exhaust fumes of older diesel engines, construction equipment, and direct-injection petrol engines. In Vienna, more than half of PM<sub>2.5</sub> emissions are caused by traffic and transport. The WHO has classified diesel exhaust particulates as carcinogenic.

### Diesel exhaust particulates are a major problem in Austria

At 56%, the share of diesel cars in Austria is twice as large as in Germany. While newer vehicles have filters, around 1.7 million of the 2.6 million diesel cars in Austria are not equipped with particulate filters as standard. In addition, the number of direct-injection petrol engines is growing strongly. Their exhaust fumes are up to 14 times above the Euro 5 particle number emission limit. Measurements have shown that the polluting effect of new Euro 5 and Euro 6 vehicles under real driving conditions is considerably higher than claimed.

### Inadequate limits and not enough monitoring sites

Particulate matter is currently measured in weight. Due to the extremely low weight of the particularly harmful ultrafine particles, however, this is not sufficient. It would be more adequate to measure the number of particles in air.

There are over 120 monitoring locations for PM<sub>10</sub> particulate matter in Austria, while the more dangerous PM<sub>2.5</sub> particles are only measured at just above 20 locations. The US, in contrast, introduced comprehensive monitoring of PM<sub>2.5</sub> in 1998. There are also no adequate limits. We have no threshold for PM<sub>2.5</sub> daily averages. In the US, the annual average

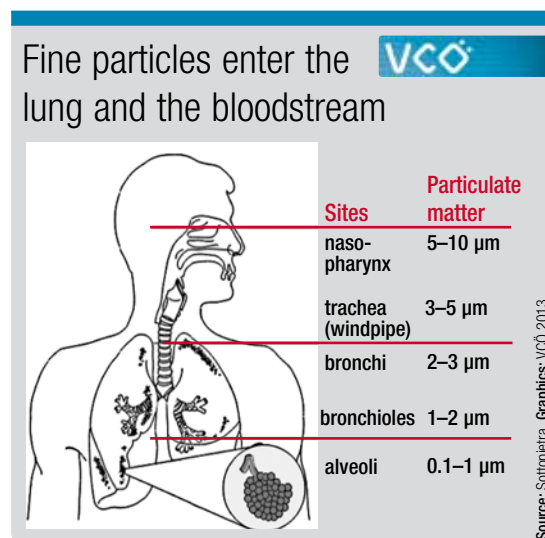
of PM<sub>2.5</sub> may not exceed 12 µg/m<sup>3</sup> (micrograms per cubic metre of air), while the EU threshold is currently 25 µg/m<sup>3</sup> and will still be 20 µg/m<sup>3</sup> from 2015 on. One reason for the stricter standard in the US is that only 2% of new cars have a diesel engine, while in the EU it is more than 50%.

### Clean air saves costs

19,000 premature deaths are caused every year in 25 European cities with a total of 39 million inhabitants by exceeding the WHO threshold for PM<sub>2.5</sub>. Reducing PM<sub>2.5</sub> emissions to the WHO limit would increase average life expectancy by nine months. Poor air quality in the EU causes an estimated 630 billion euro in health care costs and productivity losses equalling 169 billion euro annually. This could easily be counteracted by reducing air pollution: According to the European Commission, the EU could generate economic gains of 75% by investing just 20% of that cost into clean air measures. The US Environmental Agency estimates that each dollar invested in clean air technology generates gains between \$12 and \$171.

### Harmful to children:

The noxious substances produced by traffic can cause asthma and bronchitis in children and stunt their physical development.



### In the bloodstream:

The smallest particles can enter the alveoli and the bloodstream, which transports them to organs such as the liver, the kidneys, the spleen or the brain. The smaller the particles, the larger their total surface and damage caused.

# VCÖ: Health must be given priority



## Successful congestion charge:

In Stockholm, the congestion charge reduced traffic and improved air quality considerably.

The population in many parts of Austria is exposed to what the WHO considers harmful levels of PM2.5. Far too little attention is paid to protecting people's health and there is a lack of political will to introduce traffic reduction measures. People's health must be given higher priority. Even Germany and Italy, traditional car-producing countries with a high rate of vehicles per capita, consider traffic-reduction measures normal. Between them, these two countries have 150 cities with low emission zones, which high-polluting vehicles may not enter. Many European cities have already introduced congestion charges: London, Stockholm, Oslo, Bergen, Milan, and Gothenburg. Congestion charges and low emission zones reduce pollution from traffic and improve air quality.

## Better air quality through lower speed limits

A series of tests in Switzerland found that particulate matter emitted by cars and lorries on motorways dropped by up to 27% when the speed limit was lowered from 120 to 80 kilometres per hour. A speed limit of 100 km/h on Tyrolean motorways reduced PM10 emissions from cars by 18%. Reducing the speed limit from 100 to 80 km/h on rural roads increases road safety and reduces emissions.

Old lorries and construction machinery should be equipped with particulate filters and the tax break for diesel fuel must be abolished: Although it is more harmful to health, diesel fuel is taxed 8.5 cents less per litre than petrol. A survey by the Austrian market research institute "market" shows that 58% of respondents in Austria consider pollution from traffic the largest environmental problem.

**Sources inter alia:** EEA: Air quality in Europe, 2012; WHO: Health effects of transport-related air pollution, 2005; Aphekom: Summary report of the Aphekom project 2008–2011; VCÖ: Mehr Lebensqualität in Städten durch nachhaltige Mobilität, 2012; Schins R.P.F./IUF: Effects of Subchronic Inhalation Exposure to Diesel Engine Exhaust in the 5xFAD Mouse Model of Alzheimer's Disease, 2012

## • prioritise health

### Stricter threshold for PM2.5

Diesel exhaust fumes are one of the main sources of harmful particulate matter. The WHO recommendation of 10 µg per cubic metre of air should be introduced as a binding limit. A daily limit, like in the US, should be introduced as well.

### Lower speed limits improve air quality

Reducing the speed limit from 100 to 80 km/h on rural roads and introducing a speed limit of 100 km/h on more motorway sections would reduce emissions.

### Introduce congestion charges and low emission zones in Austria

Low emission zones and congestion charges reduce traffic and air quality problems noticeably.

### Compulsory particulate filters for construction equipment and lorries

Particulate filters reduce diesel exhaust particulate emissions considerably.

### Abolish tax break for diesel fuel

Diesel exhaust fumes contain more pollutants than petrol exhaust. The reduced tax for diesel fuels must be abolished.

### More monitoring locations for fine particulate matter

Measuring fine particulate matter (PM0.1, PM2.5) is very important from a health perspective. The number of monitoring locations in Austria needs to be increased considerably. In addition to weight, the number of particles per cubic metre of air must be measured.



### Bettina Urbanek, VCÖ:

„Health is the most valuable thing we have, but the current limits and measures against airborne pollutants are not enough to protect it. We need stricter limits and working traffic measures that improve air quality for the long term.“

Donations to the VCÖ are tax deductible in Austria.

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