

Risks of ultrafine particles in the outside air

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Executive summary

Health Council of the Netherlands



It has been clear for decades that air pollution is harmful to health. In 2018, the Health Council of the Netherlands wrote an advisory report called *Health gains through cleaner air* in which the case was made for reducing the levels of particulate matter and nitrogen dioxide (NO₂) in the air. Based *inter alia* on that advisory report from 2018, the former Minister for the Environment and Housing signed a ‘Clean Air Agreement’ in 2020 with the municipalities and provinces in which a package of measures for improving the air quality are described. Because there was insufficient data at the time, the effects of ultrafine particles (one component of particulate matter) were not considered.

Ultrafine particles – hereinafter referred to by the customary international abbreviation *UFP* – are a mixture of extremely small particles (smaller than 0.1 micrometre, i.e. a ten thousandth of a millimetre) that vary in terms of their origin,

composition and size. Because ultrafine particles weigh virtually nothing, they hardly contribute at all in terms of mass to the concentration of particulate matter. That is based on the weight of particles smaller than 2.5 micrometres (PM_{2.5}) or 10 micrometres (PM₁₀) and is expressed in units of micrograms per m³. UFP concentrations are generally expressed as the number of particles per cm³.

UFPs are primarily produced by combustion processes. In addition to road traffic and air traffic, there are contributions to UFP emissions from *inter alia* shipping, industry, mobile machinery (such as generators and excavators) and wood burning. There are also UFP sources in the home; this advisory report is however only about UFP levels outdoors.

More is now known about the health effects of exposure to these extremely tiny particles. The

former Minister for the Environment and Housing has asked the Health Council of the Netherlands to produce a clear overview of what is now understood and to state whether there are grounds for basing policy measures on UFP concentrations. The temporary Ultrafine Particulates Committee has examined this question.

Insights into exposure are limited

Much less is known about exposure to UFPs than to other components of air pollution. What is clear, though, is that UFP concentrations are significantly elevated near to local sources such as road traffic, air traffic and industry. It is also known that UFP concentrations vary much more widely from one place to the next than the concentrations of ‘ordinary’ particulate matter and that elevated UFP concentrations are often (but not always) associated with elevated concentrations of other components of air



pollution such as NO₂ and soot. UFP concentrations are not structurally measured or calculated in the Netherlands. As a result, there is little to no insight into the long-term trends in UFP concentrations and the contributions from specific sources.

Improved insights into health effects

The Committee distinguishes between the effects of short-term and longer UFP exposure. Studies of the effects of short-term UFP exposure suggest negative effects on the cardiovascular system and the respiratory tract (such as changes in heart rhythm and asthma attacks). The same is suggested by the results of a study carried out by the National Institute for Public Health and the Environment (RIVM) together with other research institutions into short-term exposure to UFPs from air traffic around Schiphol Airport.

Until recently, little was known about the influence of long-term UFP exposure, but understanding has improved over the last few years,

partly due to the publication of several epidemiological studies that take account of potentially confounding effects from related components of air pollution. This is in addition to the effects of other confounders such as age, socioeconomic factors and smoking.

Based on current knowledge, the Committee concludes that there is evidence that long-term exposure to UFPs increases the risk of cardiovascular conditions. There are also indications of an elevated risk of respiratory tract disorders and of negative effects on foetal growth. These health effects are associated with UFP exposure, regardless of the effects of exposure to particulate matter and NO₂, corrected for important confounding factors. Toxicological studies of the biological action mechanisms support the occurrence of these health effects. The RIVM is currently investigating the effects of long-term exposure to UFPs from aviation traffic around Schiphol. The results of this appear as expected in the

first quarter of 2022. This will further improve the understanding of the health effects of UFPs.

The number of studies into the health effects of UFPs has increased over the last few years but is still very low compared to the very extensive information about particulate matter and NO₂.

As a result, the evidentiary strength for adverse health effects of UFPs is lower than for particulate matter and NO₂, but in the Committee's opinion still providing sufficient grounds for taking additional measures.

Reduce emissions and increase the distance to the source where possible

Many of the current measures for reducing exposure to particulate matter and NO₂ also reduce UFP emissions, but supplementary measures are needed as well.

In aviation, UFP emissions can be cut by e.g. fewer aircraft movements and using kerosene with a lower sulphur content. Besides extending the use of soot filters, a further



transition to electric transport can also reduce the contribution from road traffic.

Imposing requirements for UFP emissions on various sources can also help to reduce the quantities of UFPs. In the short term, UFP exposure can be reduced further by setting up environmental zones and zero-emission zones in cities. Conditions could be imposed on emissions not only from road traffic but also from other sources (such as mobile machinery), e.g. at building sites and airports.

Industry – heavy industry in particular – may be a significant contributor to UFP exposure. The Committee argues that knowledge about that contribution and the factors involved should be extended so that targeted measures can be taken for limiting UFP emissions from industry.

In any event, for as long as the transition to electric transport remains incomplete, the Committee recommends (as in the advisory report by the Health Council of the Netherlands

in 2018) that the living environment should be configured in ways that limit elevated long-term exposure. This can for instance be done by building housing as far away from busy roads and motorways as possible.

Obtain a clear picture of the exposure

One reason why our knowledge about UFP exposure and its health effects is still limited compared to what we know about particulate matter and NO₂ is the fact there is almost nowhere where UFP levels are measured structurally. That is not only the case in the Netherlands but also in most other countries; this makes carrying out scientific research into the health effects more difficult.

The Committee recommends measuring UFP concentrations structurally in the National Air Quality Monitoring Network. Monitoring the exposure of the Dutch population to UFPs and making prognoses for the future moreover needs a record of UFP emissions nationwide. This requires structural and validated model

calculations, similar to what we have for particulate matter, NO₂ and various other components of air pollution.



The Health Council of the Netherlands, established in 1902, is an independent scientific advisory body. Its remit is “to advise the government and Parliament on the current level of knowledge with respect to public health issues and health (services) research...” (Section 22, Health Act).

The Health Council receives most requests for advice from the Ministers of Health, Welfare and Sport, Infrastructure and Water Management, Social Affairs and Employment, and Agriculture, Nature and Food Quality. The Council can publish advisory reports on its own initiative. It usually does this in order to ask attention for developments or trends that are thought to be relevant to government policy.

Most Health Council reports are prepared by multidisciplinary committees of Dutch or, sometimes, foreign experts, appointed in a personal capacity. The reports are available to the public.

This publication can be downloaded from www.healthcouncil.nl.

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