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Health risks due to nanoparticles – Epidemiological knowledge

Nanoparticles may be defined as artificial particles with a diameter below 100 nanometer. Epidemiological data on adverse health effects of these particles in humans are not yet available because the technology is too new. However, from environmental epidemiology there exists experience with particles of the same size range. These are called ultrafine particles (UFP) and originate from combustion processes. Automobile exhaust is the main source. Epidemiological research on these particles has started only during the last 5 years. UFP in ambient air have average concentrations of 10.000 to 20.000 particles/cm3 in several cities but may increase to daily maxima of 100.000 particles/cm3 and more. Due to their small size a high percentage of these particles reaches the alveoli of the airways, and since there is no effective clearance mechanism, the particles may penetrate into the lung tissue and are also found in circulating blood and other organs.
Epidemiologically, it has been shown that high daily concentrations of ambient UFP are associated with increased mortality due to respiratory and cardiovascular causes of death. In patients with asthma, more symptoms, impaired lung function and increased medication use have been found. On days with high concentrations more myocardial infarctions have been observed, as well as ECG changes in heart rate, heart rate variability, and the form of the T-wave, and effects on inflammation and coagulation in patients with cardiovascular deceases. However, many of these effects are associated with UFP and larger particles which both are in the atmosphere, and it is not always possible to identify the relevance of a specific size fraction.
Although there is an increasing body of evidence for health effects of UFP, not all studies are conclusive, and future research is needed to find clear answers. However, at this point in time epidemiological experience with UFP may be a valuable model for risk assessment of Nanoparticles.

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