Levels of several air pollutants are higher indoors than outdoors

New European research finds that the levels of several harmful air pollutants are greater indoors than outdoors, and even greater when measured on the person themselves. The measured levels of benzene are especially concerning and often indicate higher exposure than what is normally associated with the annual EU limit value set for ambient air quality.

The European Environment and Health Strategy\(^1\) recognises the importance of indoor air pollution. As part of several EU-funded research projects, the European Indoor Air Monitoring and Exposure Assessment Project (AIRMEX), has identified the main culprits and mapped their geographical distribution.

The AIRMEX study monitored indoor, outdoor and individual exposure to selected chemical compounds (aromatics, carbonyls, terpenes and other Volatile Organic Compounds (VOCs)) across Europe. A total of 991 samples were taken from public buildings, schools/kindergartens, individual volunteers and the homes of those volunteers.

Generally, the total VOC concentrations inside public buildings were higher than outdoor concentrations. The levels of VOCs showed a seasonal variation and were higher in colder months. The same trend was seen in kindergartens and schools and in most cases average levels of VOCs were twice as high indoors as outdoors. The exposure of individual volunteers was higher than average exposure to indoor concentrations and associated with smoking.

Benzene was of particular interest and concern as it is known to have cancer-causing effects. For this pollutant, 18 per cent of outdoor concentrations, 23 per cent of indoor concentrations and 30 per cent of concentrations measured on people exceeded the ambient air limit (5 microgrammes per cubic metre-annual mean) established in the European Union (Directive 2000/69/EC)\(^2\).

In all locations the concentrations for aldehydes were up to 7-8 times higher inside buildings than outside. This is particularly relevant for formaldehyde which has recently been declared a human carcinogen. Indoor levels of aldehydes increased in warmer months, particularly formaldehyde.

To identify the source of indoor pollution the study examined the ratio of indoor to outdoor pollution of VOCs. This indicated that although benzene had important indoor sources, such as cigarette smoke, it mainly originated from sources outdoors. However, other VOCs and carbonyls had additional sources within homes, such as flooring and furniture.

The researchers examined the impact of two mixtures of chemicals on human lung cells. The mixtures comprised different fractions of benzene, toluene, ethylbenzene and xylenes. Results indicated that the presence of toluene in air containing VOCs enhances immune system responses, such as inflammation. This suggests that chemical compounds interact and effects may change depending on the other chemicals present.

The researchers also suggest that the impacts of indoor air pollutants depend on individual predisposition, such as gender, stress, and genetic background. Further research is needed to evaluate these possible interactive effects.


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