

Brief, April 2025

Ultrafine particles from wood stoves in Denmark

Wood smoke increases the risk of cancer, cardiovascular diseases, blood clots and respiratory diseases, and is, according to DCE at Aarhus University, the largest Danish source of harmful air pollution. Even in Copenhagen, where wood burning covers less than 0.5 percent of the energy consumption, the latest inventory shows that wood stoves in a heating season emit more harmful particles than road traffic emits in a year despite that district heating is available and can replace wood stoves. Every year, the smoke emitted from an average wood stove in Copenhagen causes health costs of approximately €884¹. On top is the health burden in families that use wood stoves and thereby pollute their own indoor environment². Most politicians in Copenhagen wish to prohibit solid fuel (firewood) heating to protect the population from harmful smoke, however, there is still no legal basis for a ban. In other cities, woodsmoke contributes to an even higher share of air pollution.

To attain focus on harmful woodsmoke and thereby try to reduce people's use of wood stoves by switching to cleaner heating in residential areas, Green Global Future are carrying out several local pollution screenings for woodsmoke funded by *Clean Air Fund* (www.cleanairfund.org).

This brief presents the results of the first local air pollution screening made in March 2025. More measurements will be made in the fall.

Results

Ultrafine particles were measured with a P-Trak (Model 8525 Ultrafine Particle Counter) from TSI on March 24th, 2025. The screening was made in the area *Rosenvang* (part of Copenhagen municipality), where a citizen, after an article in the local newspaper, pointed out that he often smelled smoke from wood burning. The neighbourhood is characterised by one-family houses, and the screening was made by walking around in the area while measuring. When woodsmoke was nosed out, static measurements were made at the location of the smell for 8-10 minutes to establish an average.

The temperature was approximately 8-10 °C during measurements and wind conditions were 3-4m per second. Woodsmoke was detected only at two locations and static measurements were made. Most likely, more woodsmoke will be present during the cold part of the heating season where more houses use their stoves.

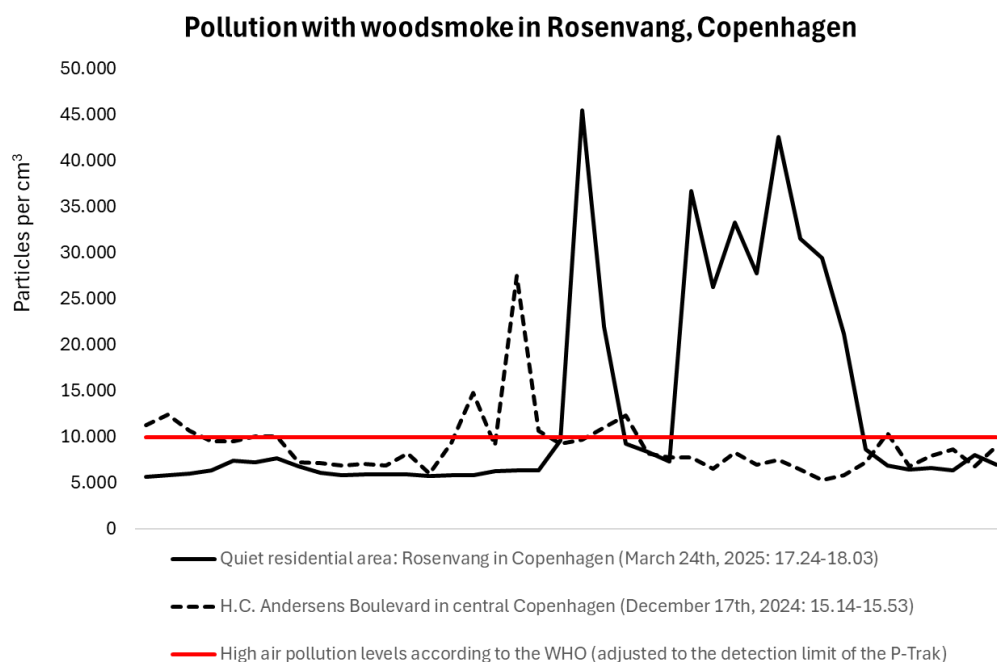
In figure 1, the results of the screening are shown. For comparison, the pollution level at *H.C. Andersens Boulevard* in downtown Copenhagen (regarded as the most polluted street in Copenhagen) is also depicted along with the pollution level that, according to the World Health Organisation (WHO), is considered as a high pollution level³.

¹ https://dce.au.dk/fileadmin/dce.au.dk/Udgivelser/Videnskabelige_rapporter_600-699/SR605.pdf

² <https://godtindeklima.nu/wp-content/uploads/2024/02/braendeovnes-forurening-af-luften-inde-i-vores-boliger.pdf>

³ Since the P-Trak is not able to detect the smallest particles (10-20 nm), the WHO-criteria is adjusted accordingly by assuming that half the particles are smaller than the detection limit of the P-Trak (20 nm) i.e. in the range of 10-20 nm.

Figure 1: Screening of wood stove pollution in Rosenvang, Copenhagen



The average pollution level in *Rosenvang* was approximately 6,000 particles per cm³ at locations without smell of woodsmoke whereas pollution levels were on average approximately 31,000 particles per cm³ at locations where woodsmoke was nosed out. For comparison, the average pollution level at the most polluted street *H.C. Andersens Boulevard* in central Copenhagen was approximately 9,000 particles per cm³ in the rush hours. Thus, woodsmoke can create much higher pollution levels of harmful particles in our peaceful residential areas than what is detected at the most polluted streets during rush hours. I.e., pollution levels in residential areas that highly exceed what the WHO considers as a high pollution level that should be avoided to protect public health.

Conclusion

The screening confirms that the air in peaceful residential areas is significantly polluted when wood stoves are used, and that ultrafine particle pollution can reach higher levels than found at Denmark's most polluted streets during rush hours, i.e. pollution levels that highly exceed the levels that the World Health Organisation considers as high pollution. Hence, it is with good reason that politicians in Copenhagen wish to replace wood burning with insulation and district heating.

Further information

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