

Indoor Particle Pollution from Residential Wood Stoves



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1 Introduction & Purpose

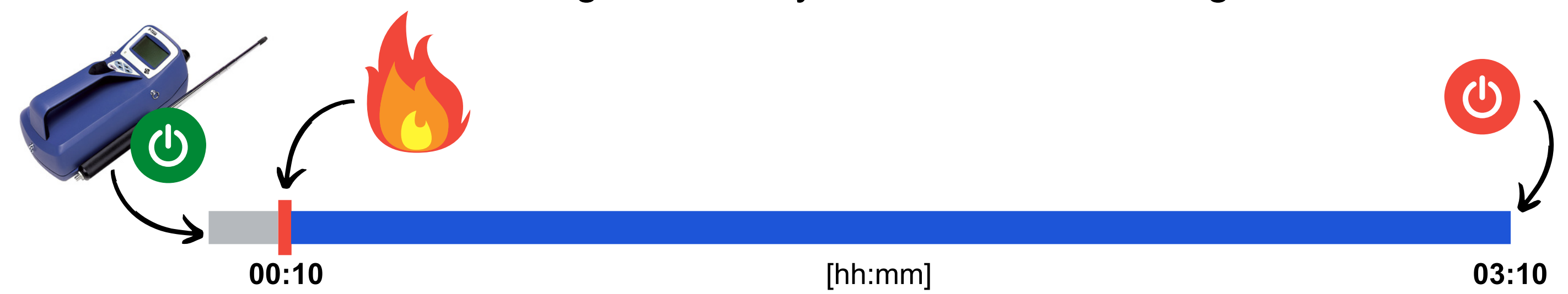
Small residential wood stoves are a well-known source to outdoor air pollution with fine particulate matter (PM_{2.5}), ultrafine particles (PM_{0.1}), and other key pollutants. However, an increasing number of recent studies also document wood stoves as a significant source of indoor air pollution. Still, new wood stoves have no limits for indoor air pollution. New technologies combining electrostatic precipitators with smoke extractors promise to reduce both outdoor and indoor air pollution from wood stoves. Studies confirm reduction in outdoor air pollution but not much documentation exist for indoor air pollution.

Purpose: To perform systematic measurements of indoor particle pollution primarily with PM_{0.1}, but also PM_{2.5}, from wood stoves and to investigate if electrostatic precipitators with smoke extractors reduce indoor particle pollution from wood stoves.

2 Methodology

Indoor particle pollution in 20 houses in Denmark with wood stoves was measured with newly calibrated P-Traks and DustTraks from TSI. Two of these houses had electrostatic precipitators with smoke extractors. In one house, measurements were conducted both before and after installing an electrostatic precipitator with a smoke extractor.

Background measurements were done for 10 minutes before igniting the wood stove. Pollution measurements were done for about three hours during the normal use of the wood stove (by the house owner). Indoor measurements were taken in a 2-4 meters distance from the wood stoves i.e. at locations where the residents would typically stay when the stove was in use, e.g. on nearby coffee table or dining table etc.



3 Results

This study confirms significant indoor air pollution with fine and ultrafine particles from some wood stoves and that the pollution can be caused by many different factors. The main findings are presented below.

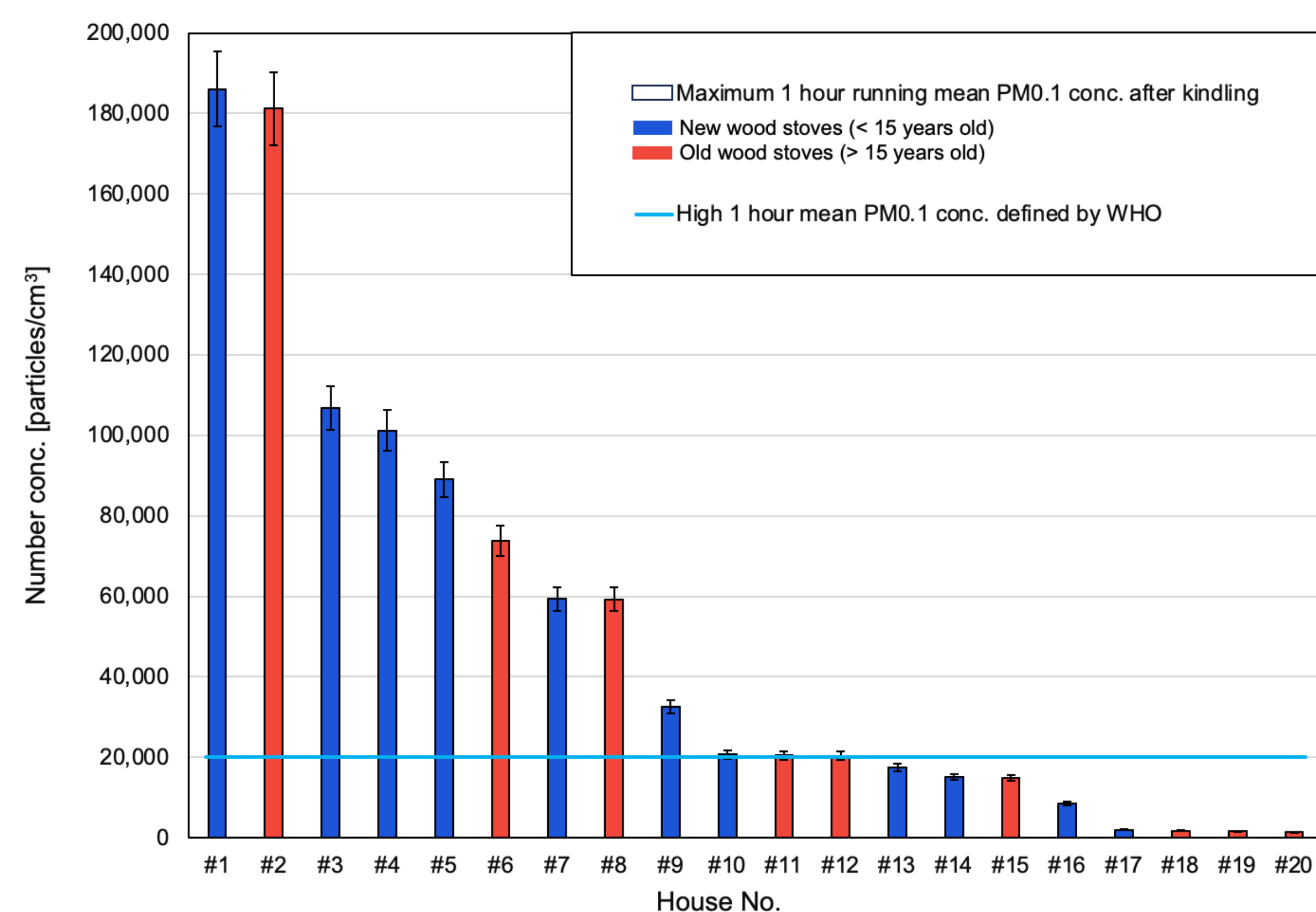


Fig. 1 Maximum 1 hour running mean of the measured PM_{0.1} concentration in all houses.

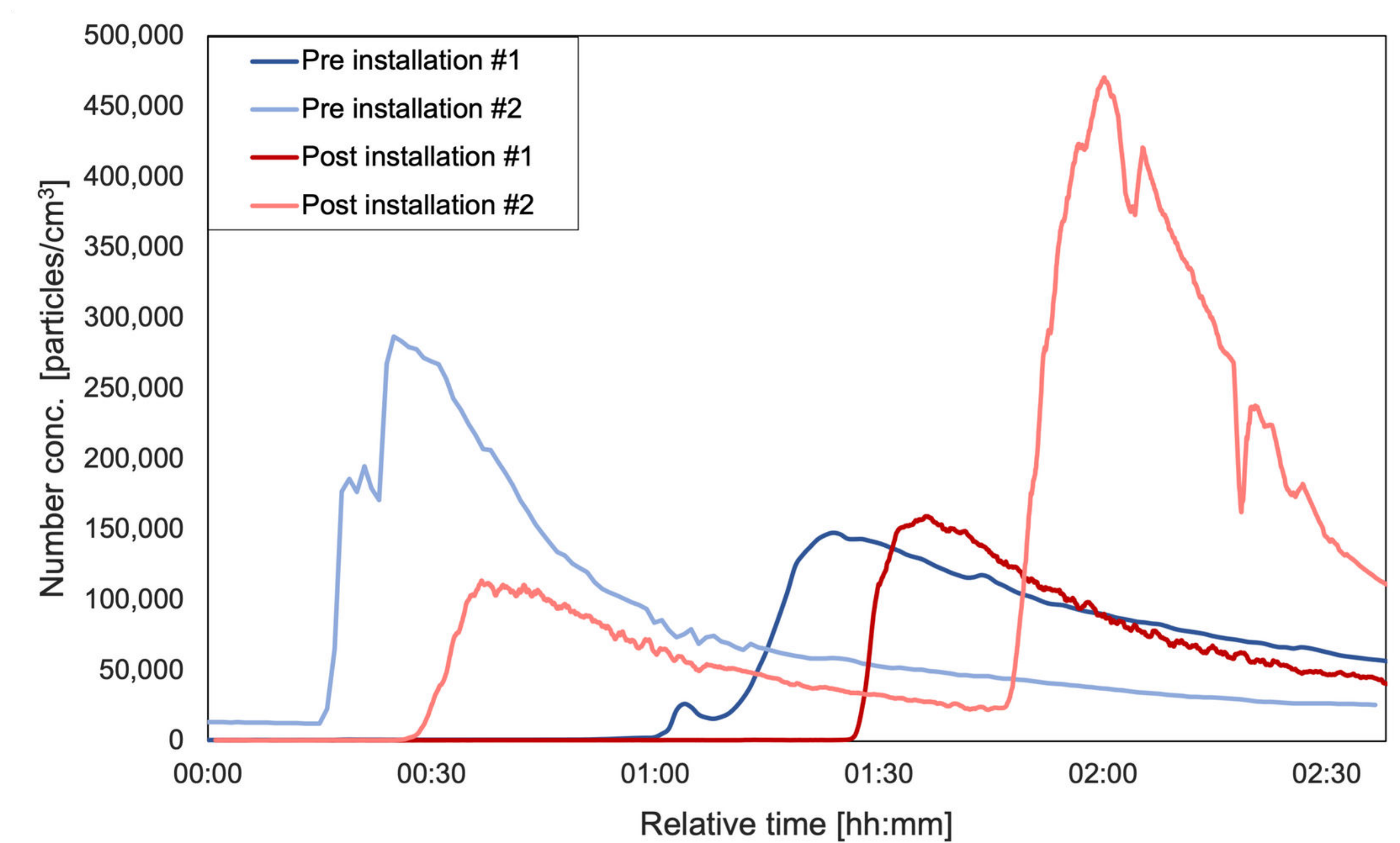


Fig. 3 PM_{0.1} concentrations measured on 4 independent days in the same house. Two measurements are conducted before and two after installation of the electrostatic precipitator.

Take-Home Messages

- Small residential wood stoves can cause significant indoor air pollution with particulate matter.
- Electrostatic precipitators with smoke extractors were not found to reduce indoor particle pollution.
- New eco-labelled wood stoves were not found to pollute the indoor environment less than old wood stoves.

Acknowledgements

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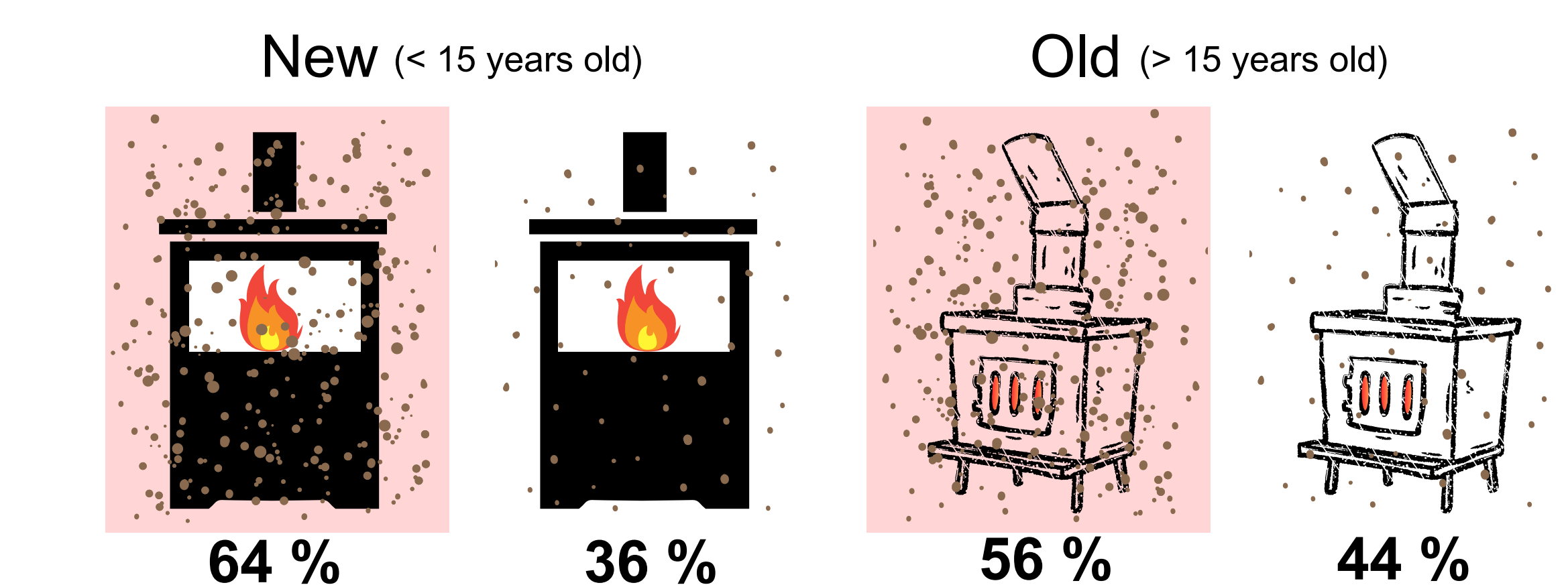


Fig. 2 Distribution by percentage of wood stoves emitting PM_{0.1} concentrations of > 20,000 particles/cm³ and < 20,000 particles/cm³ on an hourly average in the groups new (< 15 y/o) and old (> 15 y/o). > 20,000 particles/cm³ on an hourly average are considered high levels.

