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Residential indoor air quality: investigating PM_{10} and $PM_{2.5}$ sources, behaviour and environmental factors in a citizen science study.

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Links between poor air quality and health are undisputed. The amount of time we spend in our homes is increasing, and whilst outdoor air quality is regulated by national legislation and international guidance, a specific legislative framework for indoor air is still lacking. Citizen science provides an opportunity for both scientists and citizens to investigate indoor air quality (IAQ) and develop environmental health literacy through engagement activities.

Fourteen households participated in a pilot citizen science project during which particle matter (PM) concentrations were monitored using two Aeroqual 500 handheld air quality monitoring units (AQMs) over a one-week sampling period (located in the kitchen and the main living area). An activity diary for each room was completed reporting on ventilation, cooking activities, fires for heating, candle lighting or incense burning. Furthermore, a vacuum dust sample was collected and analysed by ED-XRF. An online questionnaire, to capture broader details such as home occupants, building construction, proximity to industry, and heavy road traffic was completed by all participants. Data analysis included PM source apportionment, impact of activities in adjoining rooms, impact of residents' activity pattern/behaviours and local environment on IAQ. Participants received feedback on key PM sources in their homes (see Figure 1 example), and concentrations of potentially toxic elements (PTEs) in their vacuum dust.

Concentrations in kitchens and living rooms were similar: the PM_{10} concentrations in living areas were 27 ug/m^3 (mean), 11 ug/m^3 (median), and 2964 ug/m^3 (maximum), whilst kitchens had 34 ug/m^3 (mean), 8 ug/m^3 (median) and 2905 ug/m^3 (maximum). On average, the $PM_{2.5}$ mass fraction was 58% of PM_{10} in both kitchens and living areas, although this proportion appears to be higher in homes of smokers. Maximum PM concentrations were observed in a home undergoing renovation, whilst the highest average measurements were for a home with two smokers (PM_{10} - 109 ug/m^3 and $PM_{2.5}$ - 95 ug/m^3). The indoor PM concentration data, together with ED-XRF determined metal concentrations in the vacuum dust, allowed us to estimate exposures of PTEs in airborne particulates in UK homes.

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Figure 1. Example of PM_{10} concentrations in a residential kitchen: impacts of common activities