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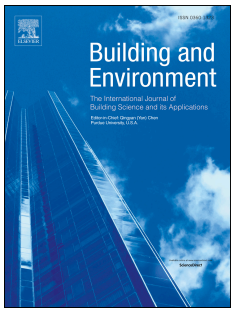

Inhalation intake fraction of particulate matter from localized indoor emissions

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Inhalation intake fraction of particulate matter from localized indoor emissions

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Abstract

Elevated exposure to airborne particulate matter is linked to deleterious health and well-being outcomes. Exposure assessment can be improved through enhanced understanding of source-receptor relationships, for example as expressed in the inhalation intake fraction metric. This study provides new knowledge about how inhalation intake of airborne particles varies with spatially varying indoor emissions. In a controlled environmental chamber with low background particle levels, we monitored the time- and size-resolved particle concentrations at multiple locations including the subject's breathing zone. We investigated two types of particle emissions: (i) controlled releases from several specific indoor locations; and (ii) natural release from skin and clothing for a range of simulated occupant activities. Findings show that particles released proximate to the human envelope caused a total inhalation intake fraction of 7–10 per thousand, which was 1.5–16× higher than the intake fraction for other indoor release locations. These outcomes reflect the influence of emissions-receptor proximity combined with the efficient transport of particles by means of the thermal plume to the breathing zone. The results show that the well-mixed representation of an indoor environment could underestimate the inhalation intake by 40-90% for various localized indoor emissions, and by up to 3× for particles emitted from the human envelope. The post-release exposure period contributed substantially to total