Bulletin de veille émissions d'aérosols par l'appareil respiratoire humain
N° 31 – Juin 2026

Objectifs : veille scientifique sur les émissions d'aérosols (gaz et particules) par l'appareil respiratoire humain (nez/bouche).

La validation des informations fournies (exactitude, fiabilité, pertinence par rapport aux principes de prévention, etc.) est du ressort des auteurs des articles signalés dans la veille. Les informations ne sont pas le reflet de la position de l'INRS. Les éléments issus de cette veille sont fournis sans garantie d'exhaustivité.

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Abouelhamd IMS, Kuga K, Ito K.

Indoor air pollution and direct second-hand exposure from single E-cigarette puff.

Build Environ. 2026;302:18.

https://www.sciencedirect.com/science/article/abs/pii/S0360132326006347?via%3Dihub

Quantification of short-term second-hand exposure to e-cigarette emissions remains limited due to ethical constraints associated with subjective measurements. Alternatively, transient computational fluid dynamics (CFD) simulation coupled with multicompartment physiologically based pharmacokinetic (PBPK) models have been applied to predict indoor, dermal, respiratory, and ocular exposure. Human smoker and nonsmoker bodies and airway models were positioned face-to-face at 0.5 m distance in a displacement-ventilated room. Three PBPK models were integrated within the CFD framework to estimate the absorption fluxes and concentrations of 49 substances in airway mucus, skin surface lipids (SSL), and corneal layers of nonsmoker. Results demonstrated that e-cigarette users exhale, on average, approximately 9-37% of the inhaled mass, depending on puff flow rate. The suspended fraction in indoor air strongly governed by compound solubility in mucus and SSL layers, ranging from similar to 90-99% of the exhaled puff. Secondary exposure occurred predominantly via dermal and inhalation pathways, with ocular uptake contributing less but remaining relevant for acute irritation for specific substances. Inhalation exposure was highly sensitive to puff-jet direction, nonsmoker breathing conditions, and diffusivity in air, with values between 0.5-6.8% of total exhaled mass. Downward-oriented puffs increased near-body residence time, enhancing dermal uptake to 8.8% for highly soluble compounds (clothing effects excluded). Overall, for the simulated conditions considered in this study, second-hand exposure reached 4.5-10.2%, demonstrating that even single e-cigarette puff can yield meaningful passive exposure. These findings highlight the need to reassess current regulations restricting e-cigarette use in indoor environments.

Alinaghipour B, Niazi S, Groth R, Miljevic B, Ristovski ZD.

Physicochemical Diversity of Cough-Generated Respiratory Particles Revealed by Single Particle Analysis.

ACS ES&T Air. 2026;3(6):1655-63.

https://pubs.acs.org/doi/abs/10.1021/acsestair.6c00096

The size, morphology, and chemical composition of exhaled human respiratory particles influence their aerodynamic behavior and their potential to carry and transmit infectious agents. However, the physicochemical properties of these particles remain poorly characterized on the single-particle level. In this study, we analyzed human cough particles exhaled by seven healthy adults by using scanning electron microscopy and energy-dispersive X-ray spectroscopy (SEM/EDS). This study provides direct, single-particle evidence of chemical and morphological heterogeneity in cough aerosols that is not accessible from bulk aerosol measurements. Cough particles exhibited a bimodal size distribution consistent with emissions from both the lower and upper respiratory tracts. Principal component analysis followed by k-means clustering revealed four chemically distinct particle classes, based on particle number: 54% carbonaceous, 3% Cl-rich, 16% P/S-rich, and 27% mixed salt. Area-equivalent volume fractions showed a different pattern with carbonaceous, Cl-rich, P/S-rich, and mixed salt particles contributing 27%, 41%, 1%, and 31% of the total area-equivalent volume, respectively. Each group showed characteristic differences in size and morphology. Cl-rich particles were larger and less spherical, while carbonaceous and P/S-rich particles were smaller and more spherical. Elemental correlation patterns, particularly among Na, Cl, K, and S, suggest heterogeneity in the particle origin along different regions of the respiratory tract. The distribution of particle types varied across individuals, indicating interindividual heterogeneity in the respiratory fluid composition. Together, these findings demonstrate that cough particles are chemically and morphologically diverse, forming heterogeneous microenvironments with important implications for pathogen stability, hygroscopic growth, and airborne transmission.