Bulletin de veille émissions d'aérosols par l'appareil respiratoire humain
N° 11 – Août 2024

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.

Les liens mentionnés dans le bulletin donnent accès aux documents sous réserve d'un abonnement à la ressource.

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Liu F, Zhang L, Qian H.

The penetration phenomenon of the expiratory airflow from thermal plume of human body in the microenvironment around people.

Build Environ. 2024;259:12.

https://doi.org/10.1016/j.buildenv.2024.111656

Understanding the influence of the human body's thermal plume on exhaled airflow is crucial for accurately assessing indoor infection risks. This study employs numerical simulations and a jet integral modeling method to investigate the airflow dispersion patterns of a single thermal manikin during sustained expiration. It was found that the thermal plume formed a two-stage evolution in exhaled airflow. Initially, the airflow was weakened by the thermal plume in the horizontal dispersion, and subsequently it was bent due to the entrainment of the surrounding air in the upward dispersion of the exhaled airflow. The thermal plume changes the trajectory and lateral dispersion distance of exhaled airflow. When the exhalation velocity is 1 m/s, the airflow is fully deflected towards the head plume region. When the exhalation velocity is between 1.5 and 2 m/s, the airflow is partially deflected, with only part of the upper airflow deflected towards the head plume region. In addition, it is interesting to note that the plume changes the dispersion trajectory of the exhaled airflow, while still adhering to the distributions of buoyant jet flow. This study suggests that the thermal effect of the human body is a significant factor in characterizing the dispersion of exhalation airflow and aerosols. Considering the thermal plume in indoor infection risk assessment is expected to yield more reliable data for theoretical modeling of respiratory airflow transport.

Moseley B, Archer J, Orton CM, Symons HE, Watson NA, Saccente-Kennedy B, et al.

Relationship between Exhaled Aerosol and Carbon Dioxide Emission Across Respiratory Activities.

Environ Sci Technol. 2024:7.

https://pubs.acs.org/doi/full/10.1021/acs.est.4c01717

Respiratory particles produced during vocalized and nonvocalized activities such as breathing, speaking, and singing serve as a major route for respiratory pathogen transmission. This work reports concomitant measurements of exhaled carbon dioxide volume (VCO2) and minute ventilation (VE), along with exhaled respiratory particles during breathing, exercising, speaking, and singing. Exhaled CO2 and VE measured across healthy adult participants follow a similar trend to particle number concentration during the nonvocalized exercise activities (breathing at rest, vigorous exercise, and very vigorous exercise). Exhaled CO2 is strongly correlated with mean particle number (r = 0.81) and mass (r = 0.84) emission rates for the nonvocalized exercise activities. However, exhaled CO2 is poorly correlated with mean particle number (r = 0.34) and mass (r = 0.12) emission rates during activities requiring vocalization. These results demonstrate that in most real-world environments vocalization loudness is the main factor controlling respiratory particle emission and exhaled CO2 is a poor surrogate measure for estimating particle emission during vocalization. Although measurements of indoor CO2 concentrations provide valuable information about room ventilation, such measurements are poor indicators of respiratory particle concentrations and may significantly underestimate respiratory particle concentrations and disease transmission risk.