

Supplementary file 7

Estimation of how in vitro exposure concentrations compare with real-life data

High reported ambient air concentration of organic carbon ^{1,2} :	45 µg/m ³
One breath of an adult:	~0.5 l (or 0.005 m ³)
Assumed breaths per minute:	15
Nasal cavity area (not accounting for microvilli or kinocilia) ³ :	160 cm ²
Concentrations with measurable effect of mucosal model <i>in vitro</i> (this study):	4 and 8 µg/cm ²

One breath will contain $45 \mu\text{g}/\text{m}^3 \times 0.005 \text{ m}^3 = 0.225 \mu\text{g}$ particles

Assuming an even distribution of inhaled air, any one cm² of the nasal cavity will be exposed to

$0.225 \mu\text{g} / 160 \text{ cm}^2 = 0.0014 \mu\text{g}/\text{cm}^2$ nasal mucosa in one breath

To reach an exposure of 4 µg/cm², a person has to breath

$4 \mu\text{g}/\text{cm}^2 / 0.0014 \mu\text{g}/\text{cm}^2 = 2\,857$ breaths

This corresponds to

$2\,857 \text{ breaths} / 15 \text{ breaths/minute} \approx 190$ minutes of breathing 45 µg/cm³ would cause an exposure of 4 µg/cm² in the nasal cavity.

For the highest applied concentration ($4 \mu\text{g}/\text{cm}^2 \times 2 = 8 \mu\text{g}/\text{cm}^2$) in this study, the same approach gives $\approx 190 \text{ minutes} \times 2 = 380$ minutes (or 6.3 h) for the highest concentration used (8 µg/cm²).

References:

1. Park, Hyunhee, et al. "Exposure assessment of elemental carbon, polycyclic aromatic hydrocarbons and crystalline silica at the underground excavation sites for top-down construction buildings." *PloS one* 15.9 (2020): e0239010.
2. Ferree, Patrick L., et al. "Airborne particulate matter and diesel engine exhaust on infrastructure construction sites in the Copenhagen metropolitan area." *Annals of Work Exposures and Health* 68.8 (2024): 791-803.
3. Gizurarson, Sveinbjorn. "Anatomical and histological factors affecting intranasal drug and vaccine delivery." *Current drug delivery* 9.6 (2012): 566-582.