Personal care product VOC emissions: Indoor air quality and estimated inhaled dosage

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The growth in significance of solvent VOC emissions

- Personal Care Products
- Household Cleaning Products
- Cooking Activities
- Other sources (Building materials, furniture, paints, varnishes, etc.)

Lewis et al. 2020
What products do we use and what is in our homes?

- Study of 60 UK homes
- Deodorants were the most frequently used VOC-containing product
- Aerosolised product propellants highest concentration of any VOC species found indoors

Heeley-Hill et al. 2021
Complexity and variability of personal care products

There are thousands of different consumer products of basically unknown and varied composition used frequently in indoor environments.

- Aerosolised-product propellants (Propane, butane)
- Solvents (Ethanol, 2-propanol, t-butyl alcohol)
- Fragrance compounds (Monoterpenes)
- Humectants, emollients, conditioners, preservatives, and active ingredients such as UV blockers
- Contaminant species (Benzene, toluene, etc.)
Estimating emissions from PCPs using bottom-up methods

Dependent on specific product use scenarios

- Amount
- Frequency
- Ventilation
- Room size
- Surface area
- Temperature
- General composition of indoor air

Yeoman et al. 2020
Estimating future emissions from aerosolised products

- Aerosol propellant VOCs currently represent around 1% of global anthropogenic emissions

- Global emission of approximately $2.2 \pm 0.48 \text{Tg year}^{-1}$ in 2050

- Increase of around 70% in VOC propellant emissions by 2050 from present day

Yeoman and Lewis 2021
Personal exposure vs ambient concentrations

- Inhaled dose of **ethanol 300x greater** than ambient indoor air
- Inhaled dose of **limonene 16x greater** than ambient indoor air
- 2 applications of facial product in 24 hours may be enough to exceed daily recommended exposure limits

Yeoman et al. 2021

SIFT-MS
Regulation, Building Design and Ventilation

Inhalation exposure and atmospheric fate need to be researched and regulated in the same way as oral and dermal exposure, and environmental fate in water and soil.

- **Room Size**: Smaller rooms will result in higher exposed dose to VOC pollutants.
- **Having good ventilation systems doesn’t mean people will use them**: Noise, cost to change/install, ease of cleaning.
- **Insulation**: Conserving heating/cooling requires limited or no ventilation.
- **The biggest downside to ventilation as a solution?**: Pollutants or their SOAs are just moved to outdoor air.

Improved ventilation cannot be the sole solution to poor indoor air quality.
• Lewis et al. 2020. *An increasing role for solvent emissions and implications for future measurements of volatile organic compounds.*
• Heeley-Hill et al. 2021. *Frequency of use of household products containing VOCs and indoor atmospheric concentrations in homes.*
• Yeoman and Lewis 2021. *Global emissions of VOCs from compressed aerosol products.*
• Yeoman et al. 2021. *Inhalation of VOCs from facial moisturizers and the influence of dose proximity.*