

Keywords: A-workplace, C-consumer products, C-water, dermal absorption, skin, dermal absorption, skin

WC3-02

Exposure to Organic Compounds in Indoor Air via Direct Air-to-Skin Transport: Further Considerations

C. J. Weschler¹, W. W. Nazaroff²; ¹UMDNJ - Robert Wood Johnson Medical School, Piscataway, NJ,

²University of California, Berkeley, Berkeley, CA

Abstract: We recently suggested (Indoor Air, 22, 2012) that transdermal uptake directly from air was potentially comparable to or larger than uptake via inhalation for many semivolatile organic compounds (SVOCs) commonly encountered indoors including benzo(a)pyrene, butylated hydroxytoluene, chlordane, chlorpyrifos, chrysene, diazinon, di(n-butyl) phthalate, diethyl phthalate, nicotine (free-base form) and nonylphenol. We have extended that analysis to include more than sixty volatile organic compounds (VOCs) also common indoors. For some of these compounds (e.g., aliphatic hydrocarbons, single ring aromatics, terpenes, one- or two-carbon chlorinated solvents, formaldehyde, acrolein), estimated dermal uptakes are small compared to inhalation. However, for others the ratio of dermal-to-inhalation uptake is strikingly large. The latter group includes methyl-, ethyl- and butylparaben, o-phenylphenol, common synthetic musks (Galoxide, Tonalide, Phantolide), Texanol, ethylene glycol and phenol. Relative to inhalation, transdermal uptake from air could be significant for compounds with large skin-lipid/gas partition coefficients ($\log(K_{lg}) > 5$) and small molecular weights ($MW < 230$ g/mol). For compounds with $\log(K_{lg}) < 7.5$, the time scale for sorption into skin-surface lipids is fast enough (< 5 h) for a steady-state transdermal flux model to reasonably approximate reality. Overall, the partition coefficient K_{lg} plays a key role influencing air-to-skin and transdermal transport. While SVOCs tend to have larger ratios of lipid-to-air solubilities than VOCs, uptake from air through skin can be a meaningful exposure pathway for a subset of VOCs. These findings are supported by empirical evidence: experiments with human subjects demonstrate substantial air-to-skin-to-blood transport for more than a half-dozen organics commonly found in indoor air.

Keywords: A-indoor environment, A-risk assessment, B-SVOCs, B-VOCs, C-air

WC3-03

Critical Evaluation of the Wash-in Effect

J. C. Kissel; U of Washington, Seattle, WA

Abstract: In the regulatory environment, washing of skin with soap and water is generally considered efficacious for reduction of absorbed chemical dose following dermal exposure. Provision of washing facilities is, for instance, specifically required under the US EPA's Worker Protection Standard, which applies to agricultural workers. However, some discussion can be found in the literature of a phenomenon termed the "wash-in" effect. Briefly stated, it is hypothesized that chemical transport through skin may be facilitated as a result of application of soap and water. While a limited and transient effect of this type is plausible, conditions under which soap and water washing might be contraindicated are not well defined. Results which both apparently support and contradict the wash-in hypothesis can be found in the literature. At its current state of development, the wash-in hypothesis is not useful to policy makers. A key issue is rate of absorption, so the effect is most likely to be of concern in the case of dermal exposure to acutely toxic compounds. Critical evaluation of relevant studies is being pursued simultaneously with an effort to model the effect of skin hydration and swelling on contaminant permeation. The current model describes one-dimensional transport in a two-layer membrane (stratum corneum and viable epidermis) by finite difference approximation. Water transport includes hydration and swelling of the stratum corneum, with concentration dependent diffusion. The objective of this research is to create a model of washing that can inform decontamination strategies applicable to both occupational and non-occupational scenarios.

Keywords: absorption, dermal, decontamination, skin, washing

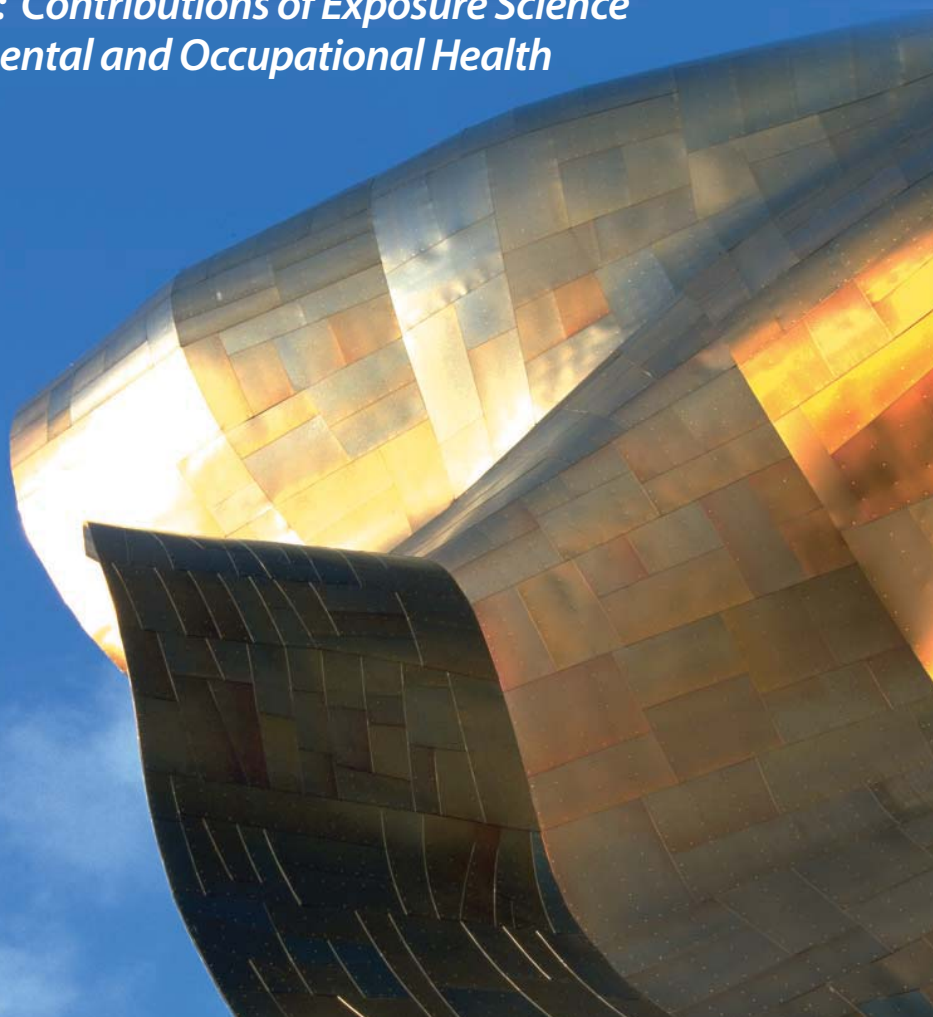


Abstract Book

22ND ANNUAL MEETING OF

The International Society of Exposure Science

*Lessons Learned: Contributions of Exposure Science
to Environmental and Occupational Health*



October 28 - November 1, 2012 — Seattle, Washington