Abstracts

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Investigation of chemical uptake at low loads on skin

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Background and Purpose/Objectives: Traditionally dermal absorption experiments have been conducted at chemical loads of 1 µg/cm2 and higher (sometimes much higher) even though many actual exposure scenarios involve delivery of lower loads to skin. Assumption of constant fractional absorption across disparate loads is common, but not well founded. Greater understanding of low-load dermal absorption is required to inform exposure and risk assessment.

Methodology: A glass and Teflon chamber was constructed to permit deposition of aerosols generated by a Collison nebulizer onto skin coupons. Fluorescent tracer and radio-labeled compounds were applied at loads of roughly 1-500 ng/cm2.

Results/Impact/Outcomes: Experiments in which a fluorescent tracer was employed provide visual evidence that distribution of tracer on human cadaver skin following low-load aerosol deposition differs from that observed following application in solvent by pipette. Subsequent experiments involving nebulization of ethanol-based solutions of 14C-labeled pentachlorophenol and chlorpyrifos demonstrated that low loads could be reproducibly applied to, and quantitatively recovered from, human cadaver skin. Substantially incomplete removal following soap and water washing at 90 minutes was observed and confirmed by counting of solubilized skin.

Conclusions and Discussion: Absorption of two pesticides delivered at low loads revealed rapid penetration to depths at which soap and water washing was ineffective. Net fractional absorption exceeded results reported in the prior literature following higher load, longer duration experiments. Results should contribute to understanding of low-load absorption and potential for decontamination by washing.

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Simulation of removal of chemicals from skin by washing

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Background and Purpose/Objectives: Washing of skin is an essential component of both industrial and personal hygiene. While many empirical studies of washing (especially hand washing) have been conducted, theoretical description of the process has been given less attention. The objective of this research is to create a model of washing that can inform decontamination strategies.

Methodology: A computer model that describes simultaneous transport of an agent of concern and water has been developed. The 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. Water transport components of the model were evaluated independently by testing against hydration experiments reported in the prior literature. The integrated model will ultimately be tested against in vivo human experiments using DEET as a surrogate for chemical contaminants. In the interim a review of the washing literature was conducted to identify prior experiments most likely to be useful in evaluation of the washing model. Key prior experiments were selected based on appropriateness of experimental protocol and completeness of reporting.

Results/Impact/Outcomes: Predicted hydration of human skin shows good correspondence with prior results reported in the literature. Evaluation of predicted washing efficiency involves multiple penetrants and is ongoing.

Conclusions and Discussion: The model described here permits investigation of the effect of washing on ultimate penetration of skin contaminants. Results should be useful in evaluating recommendations for washing in both occupational and non-occupational scenarios.

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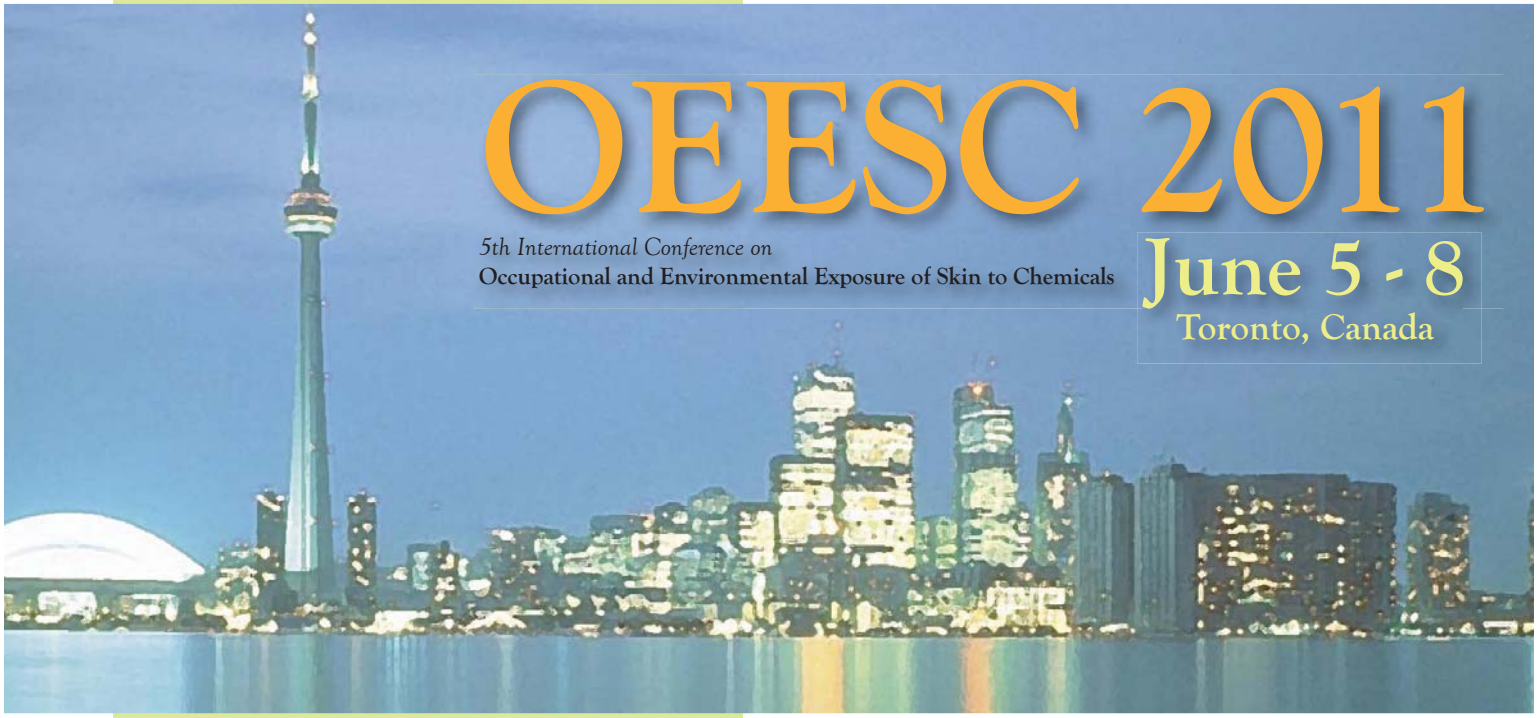

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