

# High throughput comparative exposure and risks of chemicals in multiple consumer products

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The built, natural, and social environments: impacts on exposures, health and well-being

# PROGRAM

address individual and integrated exposure to air pollutants and related health risks. We present an example of integrating such technologies to provide Personalised Real-Time Air Quality Informatics System for Exposure – Hong Kong (PRAISE-HK, http://praise.ust.hk/index.php/team/). The PRAISE-HK was built based on information of real-time emission sources and urban morphology in fine resolution, the start-of-art knowledge of physical and chemical process in meteorology and pollution transportation, as well as big data integration of sensor monitoring, location tracking and crowd sourcing to effectively analyze and forecast the air quality, personal exposure and health response in wide-scale with high resolution. The first phase of the system has been accomplished and released as a mobile application with the capability to provide real-time air quality simulation down to street level and forecast up to 48 hours. The second and third phase of the system will enable the prediction of personal exposure and health response, respectively, which will be released in 2019 and 2021. The PRAISE-HK demonstrated an example of collective intelligence to enhance evidence for policymakers and to build capacity to address air pollution, exposure and related health impacts.

**Keywords: air, community, cumulative exposure, environmental health, risk assessment**

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## High Throughput Comparative Exposure and Risks of Chemicals in Multiple Consumer Products

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Recently, increasing attention has been given to human exposure to chemicals in consumer products. Yet, Alternatives Assessment (AA), Risk assessment (RA) and Life Cycle Assessment (LCA) methods lack flexible approaches to quantify exposure and hazard for the thousand product-chemical combinations currently in use. To address this gap, we used the operational matrix-based high-throughput framework coupling multi-pathway consumer with far-field general population exposures and with hazard data. We applied it to multiple product categories as follows: a) Chemical composition was obtained from the Pharos database for building materials, from published suspect screening analysis and composition analyses for toys, and from the Stochastic Human Exposure and Dose Simulation Model (SHEDS-HT) for a series of personal care, houshold maintenance and cleaning products. b) Using seven models (skin surface layer, object surface layer, article interior, indoor air, food contact material, pesticide residues, direct emission), we calculate Product Intake Fractions (PiF) for various receptors, and c) we compare total user intake dose with observed or in silico NOAEL data to quantitatively characterize risks via vizualization of margins of exposures. Chemicals in toys identified via the suspect screening analysis had exposures from 10-8 to 0.1 mg/kgBW/d and margin of exposure greater than 100, deeming them relatively safe. In contrast, chemicals in toys with known weight fractions had much lower margins of exposure. For building products, several of the chemical-product combination yielded margins of exposure lower than 100, with doses between 0.001 and 1000 mg/kgBW/d for the first 50 days, with approximately 74% having margins of exposure under 100. For household products, intakes range from 10-8 to 400 mg/kgBW/d, with lowest margins of exposure associated with personal care products, cleaning products, home maintenance and other home products. The developed approach proves a powerful tool able to analyze thousands of product-chemical combinations and prioritize those requiring special scrutiny.

**Keywords: building materials, chemical prioritization, consumer and personal care products, exposure models, risk assessment**