

**Short Course Title**

High-throughput assessment of exposure to chemicals in consumer products: Global consensus building effort under the UN Environment Life Cycle Initiative

**Summary**

There is an increasing need for assessing comparative exposure to chemicals in consumer products. To address this need, the aim of this course is to introduce participants to quantitative, rapid screening level product exposure assessment methods developed in a global consensus building effort under the auspices of the United Nations Environment Programme. The course first provides a practical overview of a mass-balance based framework to assess multi-pathway human exposure to chemicals in various types of consumer products, and how to integrate this framework with human toxicity and ecotoxicity effects modelling, based on comparative and quantitative metrics. Participants will then be guided through practical examples of assessing exposure to chemicals in selected consumer product applications.

**Instructor**

Peter Fantke (pefan@dtu.dk)

Associate Professor, Technical University of Denmark, and Director of the USEtox International Centre

**Course Level**

Intermediate

**Course Outline / Format**

2:00–2:15 Introduction: Exposure to chemicals in products in different assessment contexts

2:15–2:45 Lecture: Coupled near-field/far-field exposure matrix framework

2:45–3:15 Exercise: Using the coupled consumer exposure model

3:15–3:45 Lecture: Data and models for different consumer products

3:45–4:00 Coffee break

4:00–4:45 Exercise: Assessing exposure to chemicals in selected applications

4:45–4:55 Interpretation and open questions

4:55–5:00 Course evaluation and closure

**Abstract**

To meet the increasing need for quantitatively assessing exposure to chemicals in consumer product applications for chemical prioritization, exposure characterization, and chemical substitution, this course provides a practical overview of the mass-balance based tools to assess multi-pathway human exposure to chemicals in consumer products, and how to integrate them with effects modelling based on comparative and quantitative metrics. We begin by explaining the assessment framework and basic concepts of mass balance modelling - including multiple transfers between near-field (consumer environment) and far-field (outdoor environment) compartments. We next present the fundamentals of the multi-pathway resulting exposures for consumers and the general population, reviewing high throughput data and models available for detergents, building material, food contact materials and personal care products. We will illustrate how consumer exposure can be integrated into chemical assessment studies. We then guide the participants through examples developing exposure and impact factors for various exposure scenarios. We will conclude with a discussion of how this framework fills in important gaps in current assessments and how it can be used in various science and policy fields, including the prioritization and ranking of chemicals, chemical substitution and life cycle exposure and toxicity characterization.

## Course Objectives

The aim of this course is to introduce participants to quantitative exposure assessment methods suitable for chemical substitution, life cycle impact assessment and comparative screening risk assessment. Participants will learn to use and evaluate mass-balance tools for assessing various exposure pathways, using the product intake fraction relating chemical mass intake to chemical mass in a products. Participants will work with practical examples.

The course is intended for environmental science practitioners interested in the scientific fundamentals of exposure and impact assessment of chemicals for a broad range of consumer products. Only basic background knowledge of environmental modelling, risk assessment or life cycle impact assessment is considered necessary.

Participants will gain knowledge of basic concepts of exposure science for the impact assessment of chemicals in products and be able to apply the modelling framework and interpret results.

## Products/Course materials

Short course hand-outs will be distributed in a course manual that includes copies of all lecture presentation slides as well as working materials for the exercises.

A copy of the exposure modelling tool will be distributed. The students will be provided copies of the following papers in electronic form. A list of suggested references will be provided in the course manual:

- Fantke P, Aylward L, Bare J, Chiu WA, Dodson R, Dwyer R, et al. 2018. Advancements in life cycle human exposure and toxicity characterization. *Environ. Health Perspect.* 126:125001
- Fantke P, Ernstoff AS, Huang L, Csiszar SA, Jolliet O 2016. Coupled near-field and far-field exposure assessment framework for chemicals in consumer products. *Environ. Int.* 94:508-518
- Jolliet O, Ernstoff AS, Csiszar SA, Fantke P 2015. Defining product intake fraction to quantify and compare exposure to consumer products. *Environ. Sci. Technol.* 49:8924-8931
- Huang L, Ernstoff A, Fantke P, Csiszar S, Jolliet O 2017. A review of models for near-field exposure pathways of chemicals in consumer products. *Sci. Total Environ.* 574:1182-1208
- Ernstoff AS, Fantke P, Csiszar SA, Henderson AD, Chung S, Jolliet O 2016. Multi-pathway exposure modelling of chemicals in cosmetics with application to shampoo. *Environ. Int.* 92-93:87-96
- Csiszar SA, Ernstoff AS, Fantke P, Jolliet O 2017. Stochastic modeling of near-field exposure to parabens in personal care products. *J. Expos. Sci. Environ. Epidemiol.* 27:152-159
- Shin H-M, Ernstoff AS, Arnot JA, Wetmore B, Csiszar SA, Fantke P, et al. 2015. Risk-based high-throughput chemical screening and prioritization using exposure models and *in vitro* bioactivity assays. *Environ. Sci. Technol.* 49:6760-6771

**Participants should bring their own laptop in order to follow this course.**