

WG1 Globally shipped products may out gas toxic chemicals: Experimental out gassing of toxic chemicals to simulate the characteristics of hazards tainting goods

DiMoPEX



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Introduction

Ambient monitoring analyses may identify potential new public health hazards such as residual levels of fumigants and industrial chemicals off gassing from products and goods shipped globally. Beside the fumigants the container, packaging materials and therein transported items could be tainted with various industrial chemicals like toluene, dichloromethane, **benzene** and **ethylene dichloride** (production residuals, packaging materials, cleaning activities or various chemical formulations improving the fumigant quality or its fire resistance). After arriving in harbors, closed transport units are relocated to often far-away cities or areas before they are unloaded and opened. Then the goods are distributed and used by workers, bystanders and consumers, who are often unaware of prior fumigation processes. Although evidence is emerging that products tainted with industrial chemicals may release these substances for rather long periods after accessing, there is only limited data on outgassing characteristics of diverse chemicals. The aim of our study is to provide experimental data allowing future risk assessment of possible health risks from products tainted with fumigants and industrial chemicals.

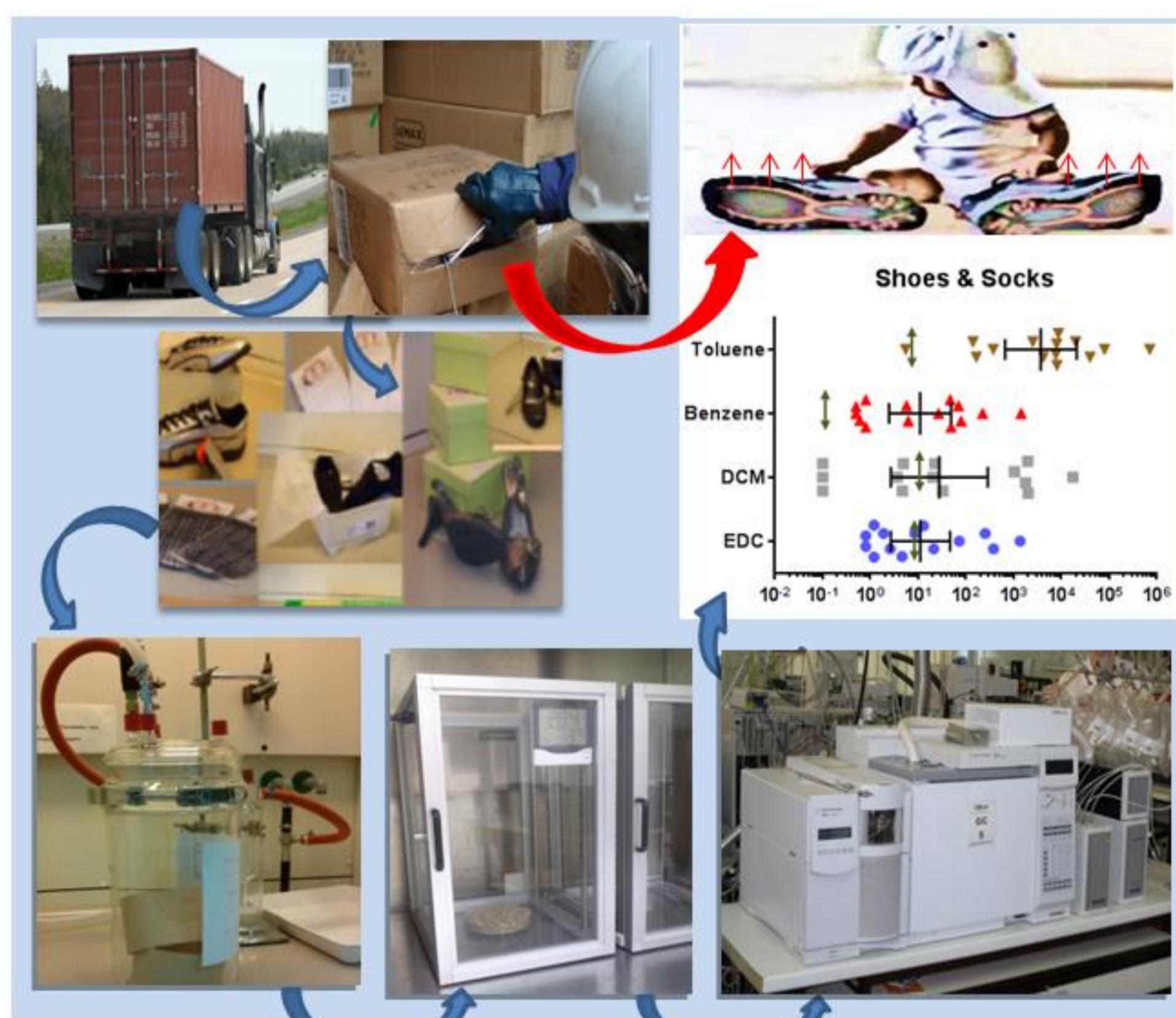


Fig 1. Study overview

Methods

We analyzed container air with gas chromatography coupled to mass spectrometry (TD-2D-GC-MS/FPD) and assessed whether the concentration of the volatiles benzene and ethylene dichloride exceeded recommended exposure limits (REL). Products were taken from transport containers and analyzed for out gassing of volatiles. Furthermore, experimental out gassing was performed on packaging materials and textiles, to simulate the hazards tainting from globally shipped goods (Fig 1).

As limit values the chronic RELs released by the US Office of Environmental Health Hazard Assessment, OEHHA were applied. Benzene: 3 µg/m³ (0.98 ppb); EDC: 400 µg/m³ (98 ppb); MeBr: 5 µg/m³ (1.29 ppb); PH₃: 0.8 µg/m³ (0.58 ppb).

References

- Experimental out gassing of Toxic Chemicals to Simulate the Characteristics of Hazards Tainting Globally Shipped Products. Lygia Therese Budnik, Nadine Austel, Sabrina Gadau, Stefan Kloth, Jens Schubert, Harald Jungnickel, Andreas Luch, submitted

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Results

The mean amounts of **benzene**, toluene and **ethylene dichloride** in container air were higher than the corresponding RELs.

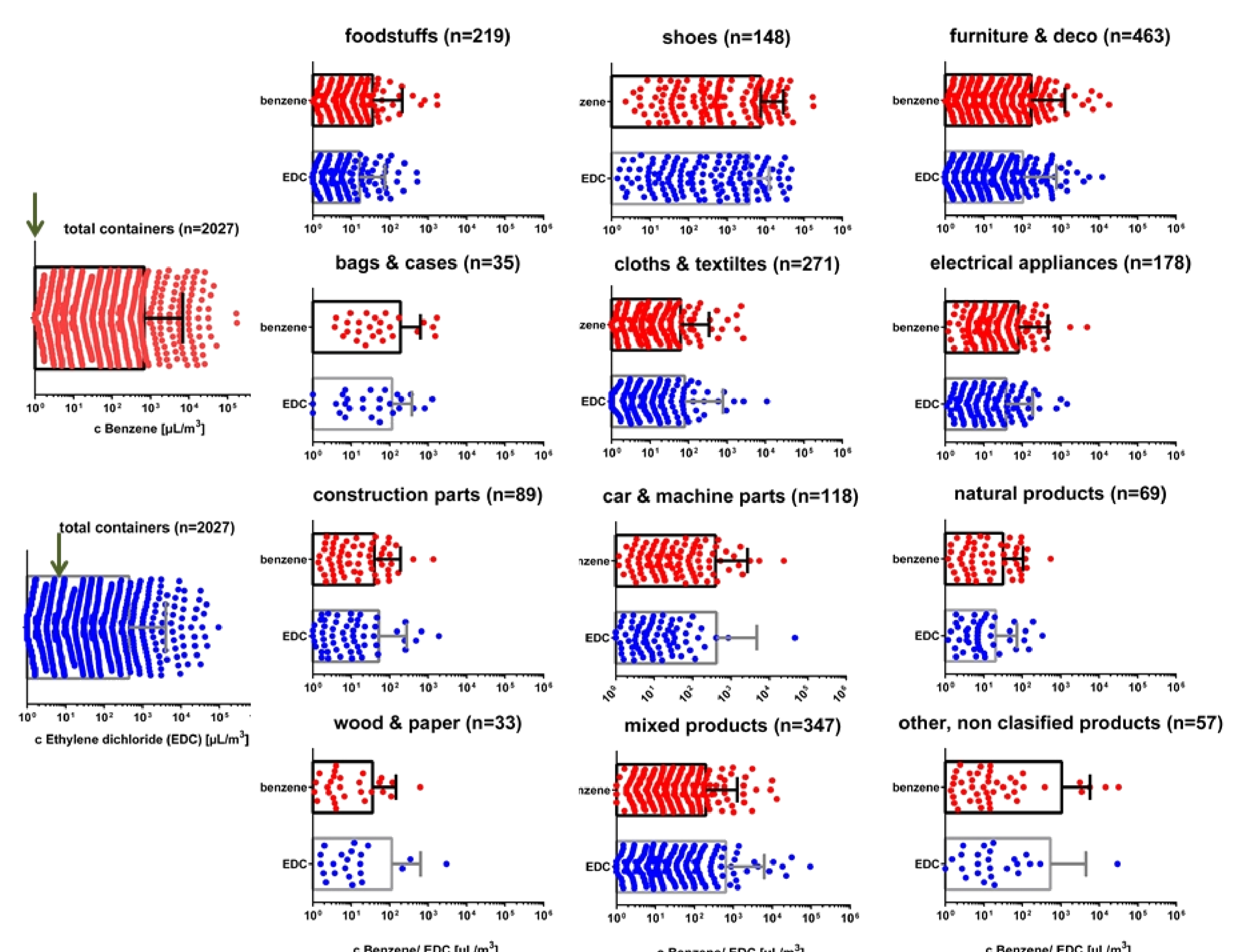
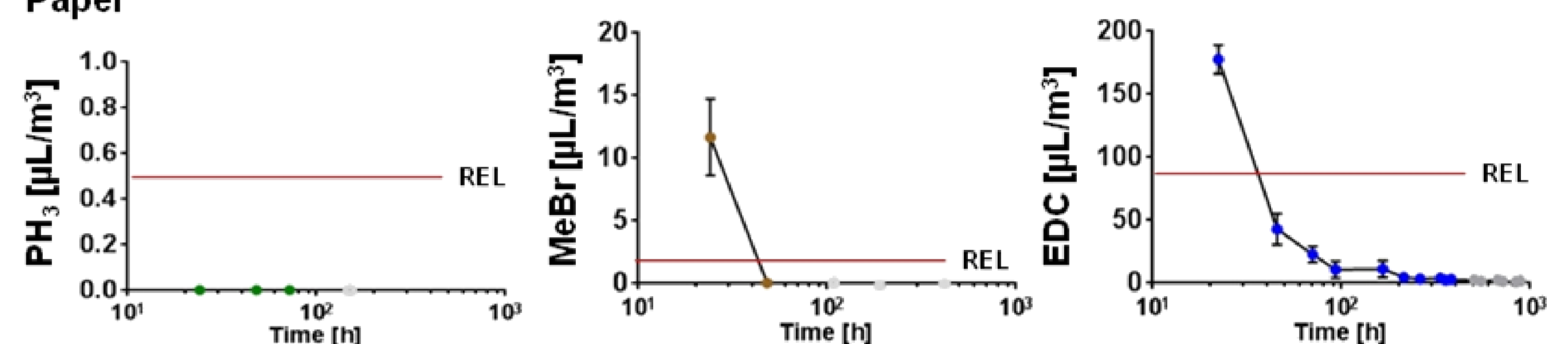


Fig 2. The amounts of the carcinogens benzene and ethylene dichloride (EDC) detected in container air in total and with respect to the transported product groups. Data show scatter plots with bars (mean ± SD).

Paper



Clothes

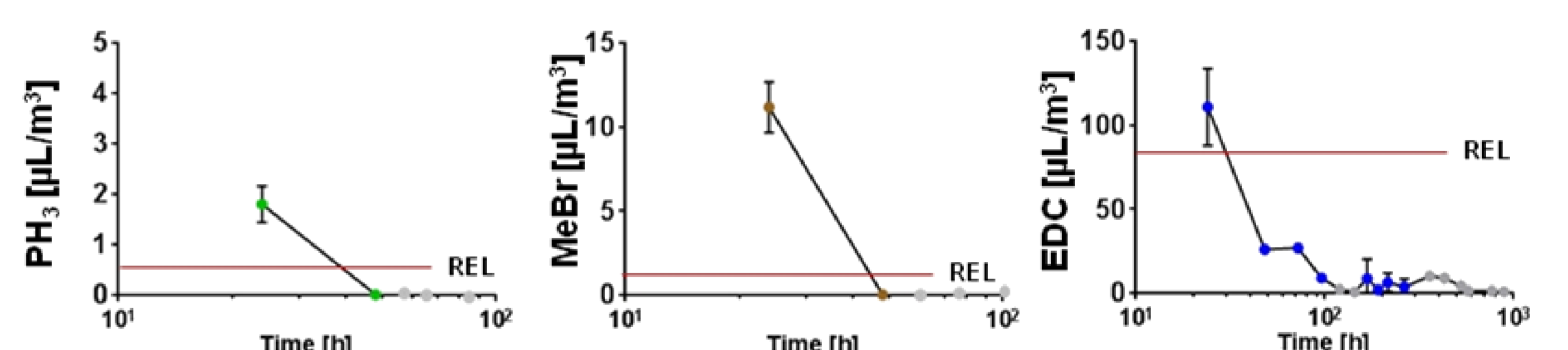


Fig 3. Experimental outgassing of fumigants from products. Two different products from the product groups of packing material and cloths were fumigated with either phosphine (PH₃), methyl bromide (MeBr) or ethylene dichloride (EDC) under controlled experimental laboratory conditions. The time-dependently released amounts of trapped and adsorbed gas were measured by TD-GC/MS. Data points show mean ± SD with n = 3, grey dots with n = 2.

Conclusions

In standardized experimental fumigation of various products, out gassing of ethylene dichloride under controlled laboratory conditions took up to several months. Globally produced transported products tainted with toxic industrial chemicals may contribute to the mixture of volatiles in indoor air as they are likely to emit for a long period [1].