Joint Research Centre (JRC)

Consumer products

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Overview

Product safety policy framework

Analytical results – chamber measurements

- JRC Indoortron measurements
- Worldwide measurements in environmental chambers

Directions for further research

Suggestions for policy measures

Product Safety in the EU

- Based on the General Product Safety Directive (GPSD) and sector Directives (e.g. toys, cosmetics, electrical equipment)
- **With the objectives to:**
  - Ensure that consumer products placed on the market are safe
  - Contribute to the proper functioning of the internal market

Obligations for economic actors

Produce and sell only safe products

Introduce proper marking to allow traceability

Monitor safety

Take necessary action to avoid risks to consumers

- Suspension of sales
- Withdrawal from market
- Warning to consumers
- Recall from consumers
- Modify products

Notify and co-operate with authorities

Obligations for Member States

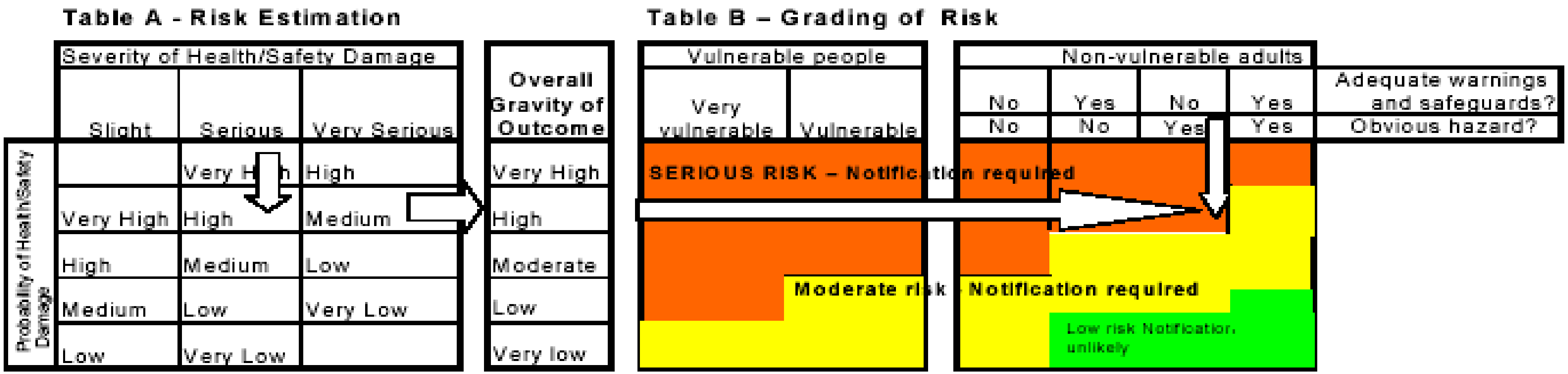
- Carry out market surveillance and enforcement
- Follow-up consumer complaints
- Co-operate and exchange information with other Member States and the Commission
- Report to the Commission

Obligations for the EC

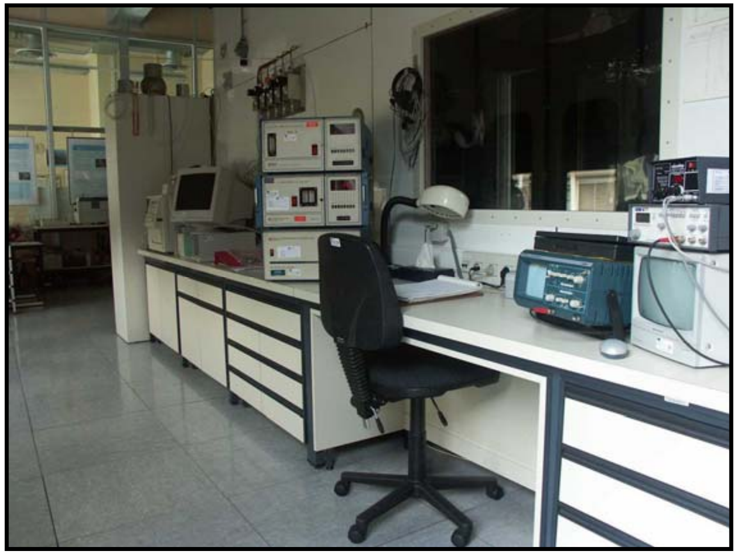
- Monitor that Member States meet their obligations
- Support market surveillance e.g. via co-financing of cross border actions and exchange of officials
- Recognise standards
- Take emergency measures if necessary

RAPEX

- European Rapid Alert System covering non-food consumer products posing serious risks to consumers
- Ensures that information about dangerous consumer products identified in one Member State is quickly circulated to the other Member States and the Commission for appropriate follow-up, with the aim of preventing their further supply to consumers



Indoortron facility



Studies on impact on indoor air quality and human exposure

Simulation of complete indoor environments: bedroom, office, kindergarten etc

Laser printer emissions

Aim

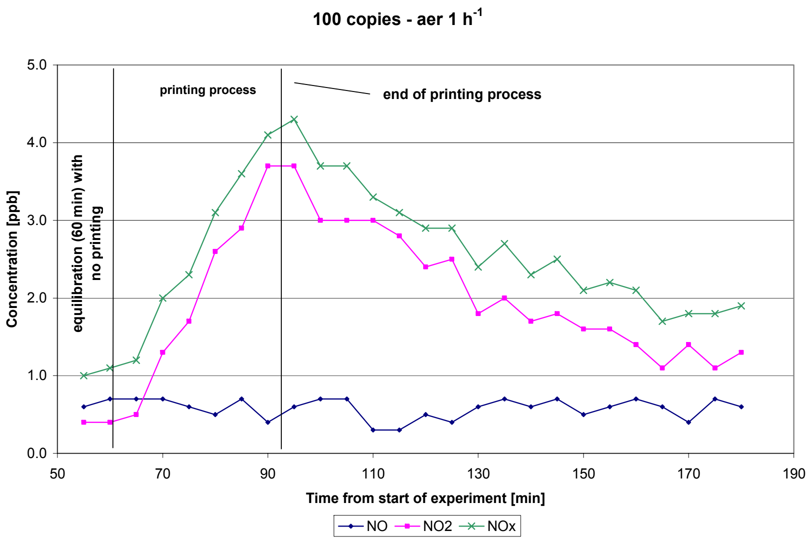
- Evaluation of emissions from printers in a real office volume setting.

Identification and quantification of pollutants such as dust, NOx, ozone, VOCs, low weight carbonyl compounds,

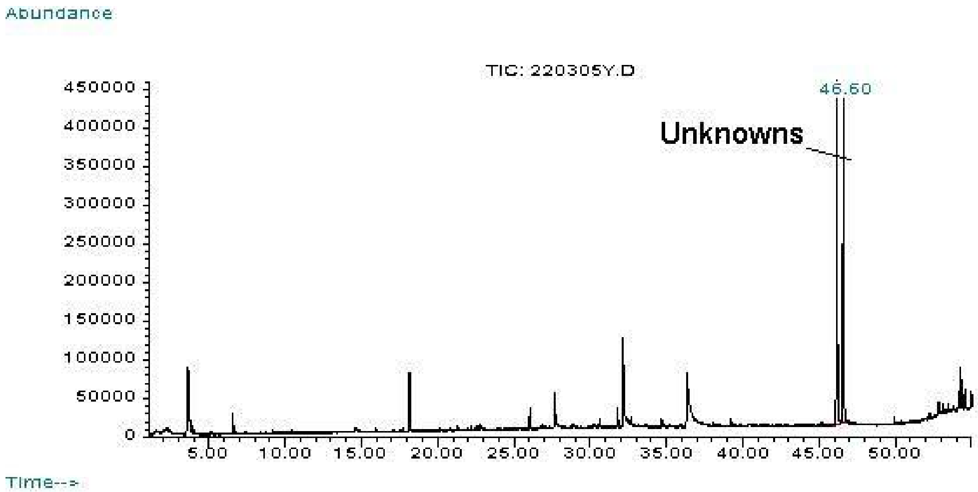
Key issues

- Tests on B&W and colour printers
- Tests old and new printers
- Evaluation pollution levels and ventilation 0.5, 1 aer

Laser printer emissions



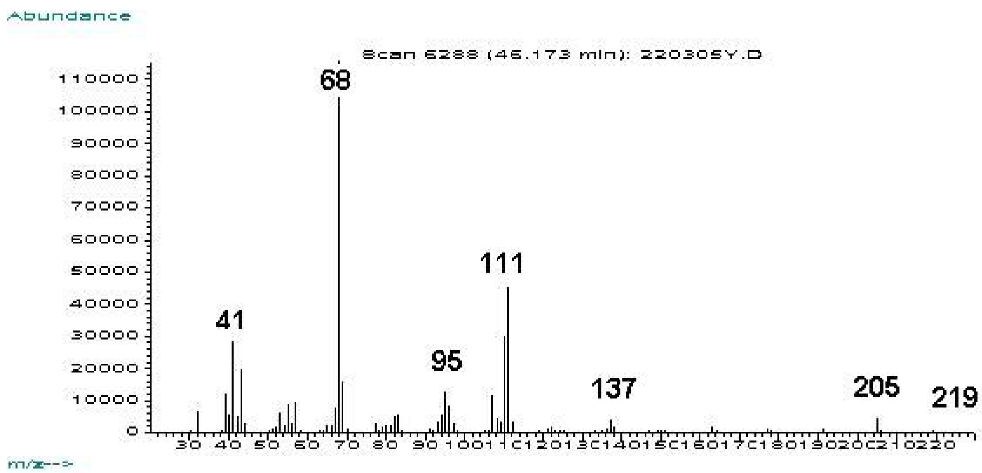
NOx monitoring: ready mode, printing and end of printing process

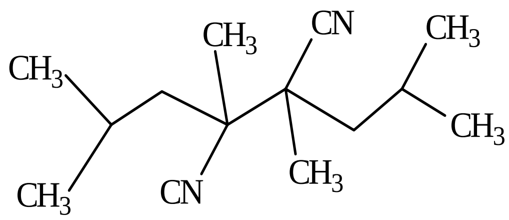


TVOC fraction during printing process

Laser printer emissions

- Very low level of Ozone and Nitrogen Oxides are produced during the printing process; in new printers this is almost near to zero.
- Very low level of VOCs and Aldehydes emissions from B&W printing process.
- Identification of a unregistered chemical in the VOC emissions of color printers (C 14 H24 N2) as 2,3 dimethyl 2,3 diisobutyl succinonitrile, byproduct of an intermediate chemical used on the toner manufacturing.





Printer emissions

Reported volatile organic chemicals (VOCs), ozone and particulate matter (PM_{10}) emitted by printers

Chemical	Laser printers[a,b]		Ink-jet printers[a]		All-in-one office machines[a]	
	Chamber concentration (ppbv)		Chamber concentration (ppbv)		Chamber concentration (ppbv)	
	Idle	In operation	Idle	In operation	Idle	In operation
VOCs						
Freon 12	0.48–0.52	0.61–0.66	0.36	0.43	0.3	0.45
Methyl chloride	0.53–0.60	0.71–0.82	0.48	0.55	0.52	0.62
Freon 11	0.24–0.29	0.25–0.28	0.23	0.24	n.d.	0.27
Methylene chloride	0.38–0.42	0.46–0.58	0.57	0.61	0.69	0.74
Chloroform	0.96–1.07	1.17–1.31	0.81	0.94	0.74	0.96
Benzene	0.52–0.57	0.77–0.84	0.42	0.41	0.52	0.52
Toluene	14–15	15–16	6.22	6.43	7.9	8.2
Tetrachloroethene			0.23	0.21	0.52	0.43
Ethylbenzene	1.4–2.1	2.0–3.0	1.2	1.26	1.5	1.6
m,p-Xylene	1.2	1.6–1.7	0.86	0.92	0.9	0.9
Styrene	2.7–4.0	3.2–5.3	1.14	1.43	1.2	1.9
o-Xylene	0.9–1.0	2.0–2.3	0.69	0.68	0.58	0.58
1,4-Dichlorobenzene			0.34	0.32	0.34	0.35
1,3-Dichlorobenzene			0.34	0.32	0.34	0.35
1,2-Dichlorobenzene			0.21	0.21	0.26	0.22
1,2,4-Trichlorobenzene			0.86	0.63	0.23	0.2
Hexachlorobutadiene			0.37	0.36	0.88	0.64
∑VOC		300–1400 (20–60 m)				
Ozone						
Ozone		9–10 1–13 (20 m)		5–6		6
Aerosol particles						
PM_{10}		65		20–38		41

Office equipment

Measurements of office equipment-relevant volatile organic chemicals (VOCs) in the indoor environment

Chemical	Photocopier centers (USA)[a] Concentration (ppb)	Office environment (review of US and European data)[b] Concentration ($\mu g\,m^{-3}$)
Pentane	0.8–6.2	
Toluene	3–4800	28–9500
p-Dichlorobenzene	3.8	
m,p-Xylene	1.7–2.9	10–59
Hexane	1.6	
Ethylbenzene	1.0–0.4	
1,2,4-Trimethylbenzene	0.4–269	
o-Xylene	0.6–0.9	
Phenol	7.8	
Nonane	0.6–525	
Decane	0.6–639	3–2370
Octane	0.5	
Undecane	0.5	
1,3,5-Trimethylbenzene	304	
Formaldehyde		38–310
Hexanal		34–520

[a]Stefaniak et al. (2000).
[b]Wolkoff et al. (2006).

Existing studies clearly show that computers emit a range of VOCs, although in most cases the relatively low emission rates suggest that these are less significant than other indoor and outdoor sources.

Computers are typically not a source of ozone or particulate matter although re-emission of ambient particles deposited in the units has been demonstrated.

The data are much more limited for SVOCs but emission factors for brominated and organophosphate flame retardants indicate levels for individual SVOC pollutants are in the nanogram (ng) per hour range.

Accumulation of SVOCs at indoor surfaces can contribute to other exposure pathways, such as dermal contact.

The influence of office equipment on the burden and distribution of indoor SVOCs through redistribution of particulate matter deserves further investigation as does the quantification of phthalate emissions that correct for background levels.

Personal exposures may be significantly larger than those estimated through average pollutant indoor concentrations, due to proximity of users to the sources over extended periods of time.

Of the total daily intake of PBDEs, 4% was by inhalation and 14% by ingestion of dust. In the case of toddlers, dust ingestion represented 80% of total daily exposure to PBDEs.

Indoor products

Quantify the release of organic substances (aromatic compounds and carbonyls) and particle matter from indoor products under realistic use conditions

insecticide sprays

characterization of short-term emissions in terms of particle size (droplets) concentration of active ingredients and the impact of ventilation.
Spray active ingredients: propoxur, piperonylbutoxide and pyrethrins

air fresheners

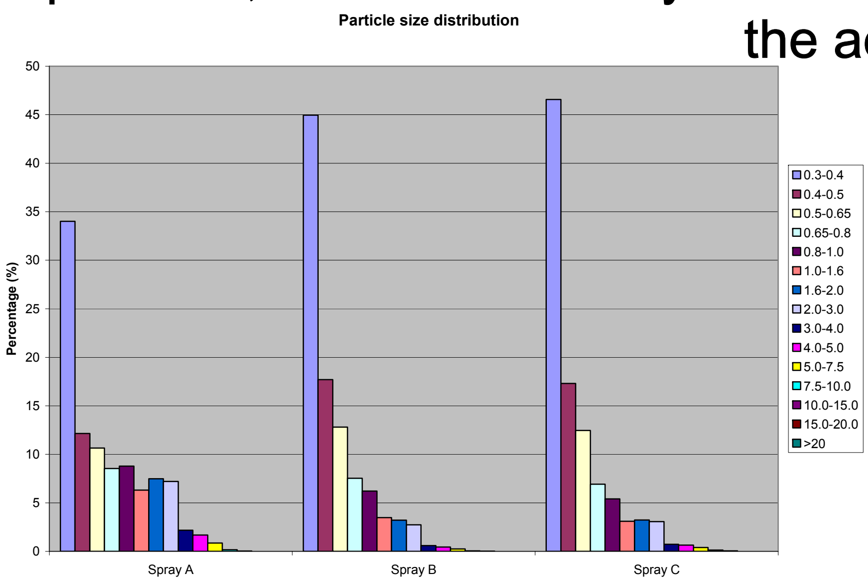
Studies on ozone-terpene chemistry. Formation of secondary organic aerosols (fine and ultrafine particles) and other reaction products.

Cleaning agents/pesticides

Substance	Mean	SD	Environment	Material	Source
[μg/m²min]					
Chloroform	15.0	0.25	Environmental Chamber	Cleaning agents & pesticides	Wallace
1,2-Dichloroethane	12.0		╫	╫	╫
1,1,1-Trichloroethane	37.0	15	╫	╫	╫
Benzene	nd		╫	╫	╫
Carbon tetrachloride	71	5.3	╫	╫	╫
Trichloroethylene	0.37	0.047	╫	╫	╫
Tetrachloroethylene	nd		╫	╫	╫
Chlorobenzene	nd		╫	╫	╫
Ethylbenzene	nd		╫	╫	╫
p-Xylene	nd		╫	╫	╫
Styrene	nd		╫	╫	╫
o-Xylene	nd		╫	╫	╫
m-Dichlorobenzene	0.56	0.02	╫	╫	╫
p-Dichlorobenzene	0.44	0.005	╫	╫	╫
n-Decane	0.17	0.027	╫	╫	╫
o-Dichlorobenzene	nd		╫	╫	╫
n-Undecane	1.1	0	╫	╫	╫

Indoor products: insecticides

Elimination of the insecticide aerosols depends on ventilation and deposition of particles, which are directly affected by the composition and droplet size of the aerosols.



The various insecticide sprays tested showed different patterns of particle size distribution

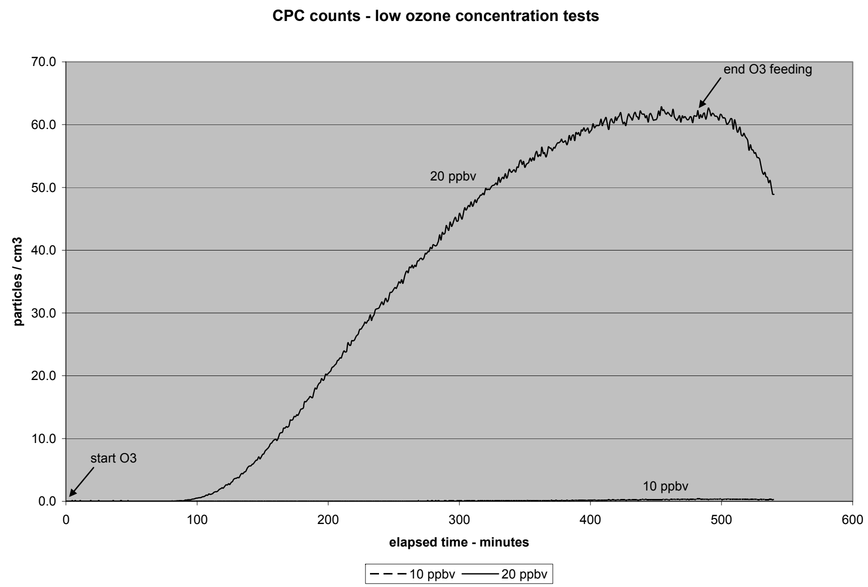
Removal rates of active ingredients is driven by deposition on the chamber

Propoxur: 91% (no ventilation) and 94% (with ventilation)
piperonylbutoxide 90-95% (no ventilation) and 93-97% (with ventilation).
Pyrethrins 74-83% (no ventilation) and 80-85% (with ventilation).

Indoor products: Air freshener

Measuring point: Center of Indooortron and 150 cm height

Monitoring of submicron particles



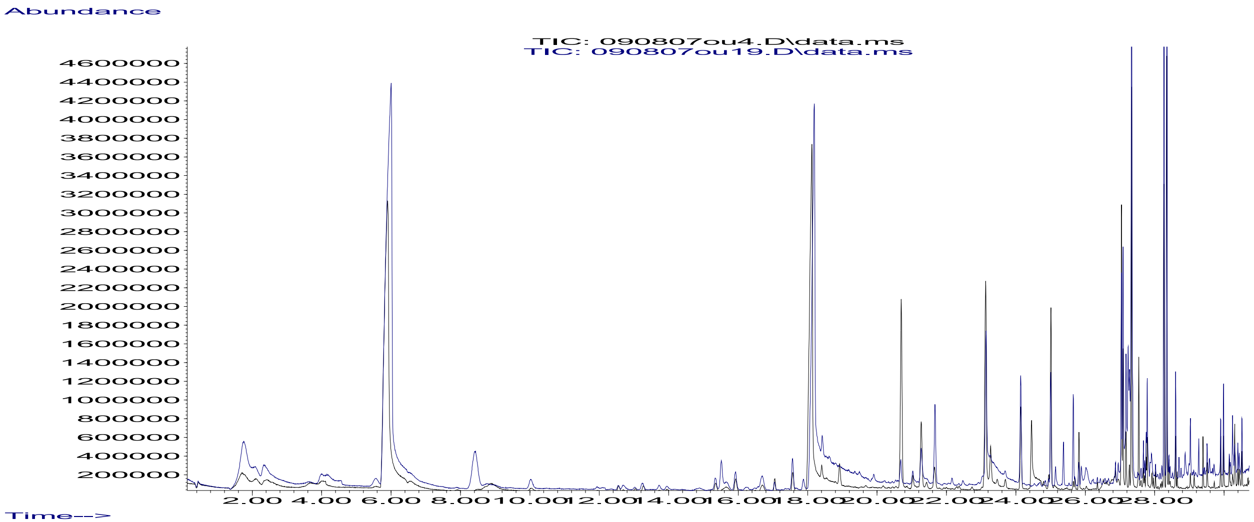
Reaction products

Formation of formaldehyde depending on the ozone level (1-5ug/m3 for 10-60 ppbv ozone)

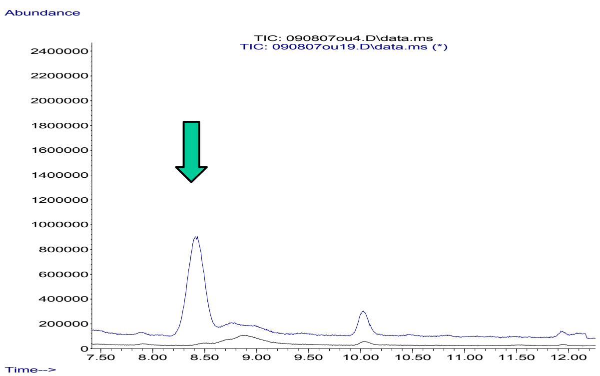
Other reaction products

Indoor products: Air freshener

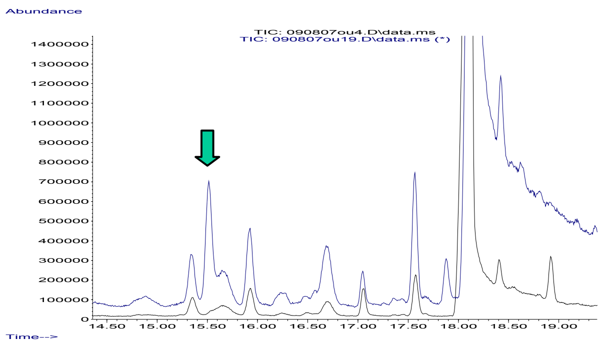
GCMS chromatograms: Black: absence of ozone. Blue: presence of ozone



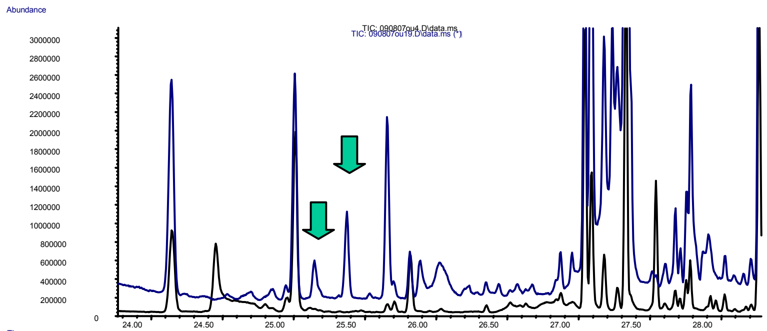
Zoom of windows



7.5-12 min

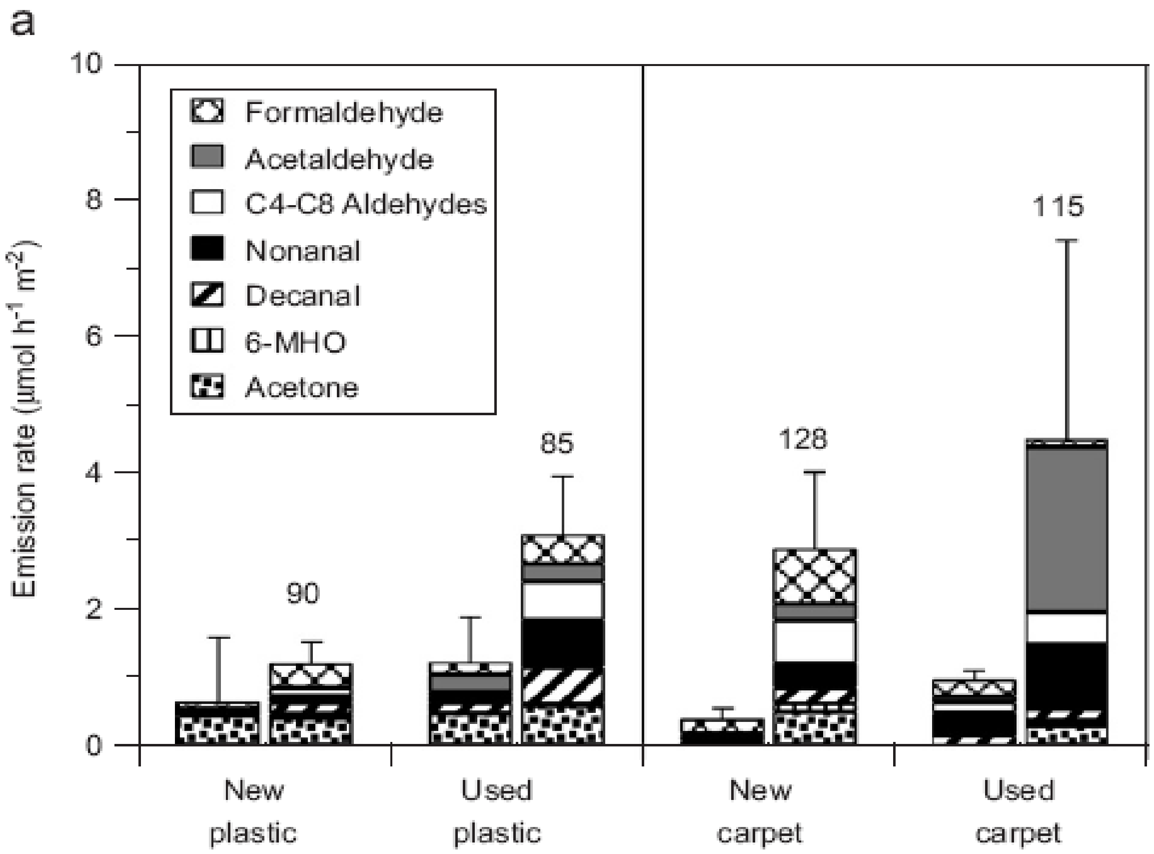


14.5-19 min



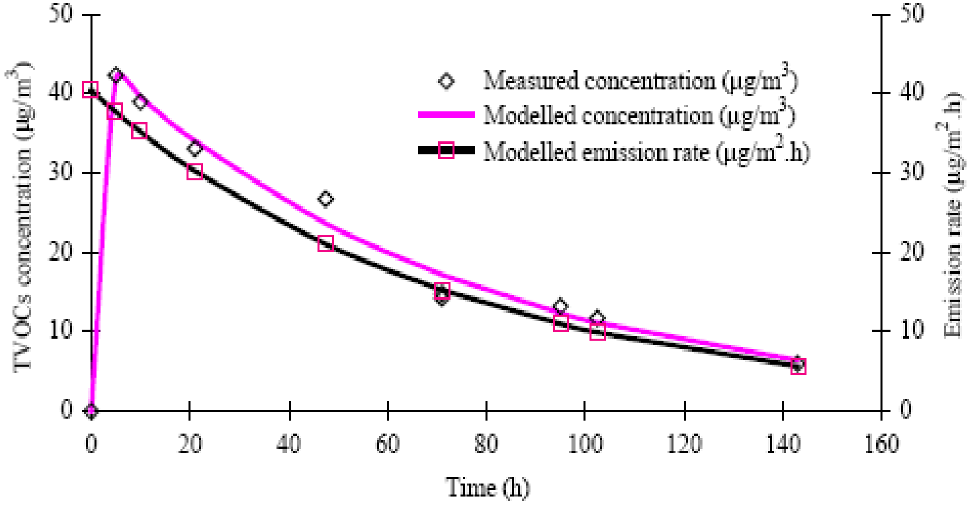
24-28 min

Plastic / carpets



Coleman et al

Fig. 3. Emission rates of selected volatile organic compounds from (a) new and used common cabin materials and (b) laundered and soiled clothing fabrics. For each material presented, the left bar represents the average emissions without ozone during a 180-min conditioning period (no ozone), and the right bar represents the average emissions during the initial 90-min ozone exposure period. The number above the right bar is the 90-min average residual ozone concentration in ppb; the supply air concentration was always 160 ppb. Error bar indicates plus one standard deviation from analysis of replicate integrated samples.



'ig. 1. The TVOCs concentration and emission rate from Stonegate carpet.

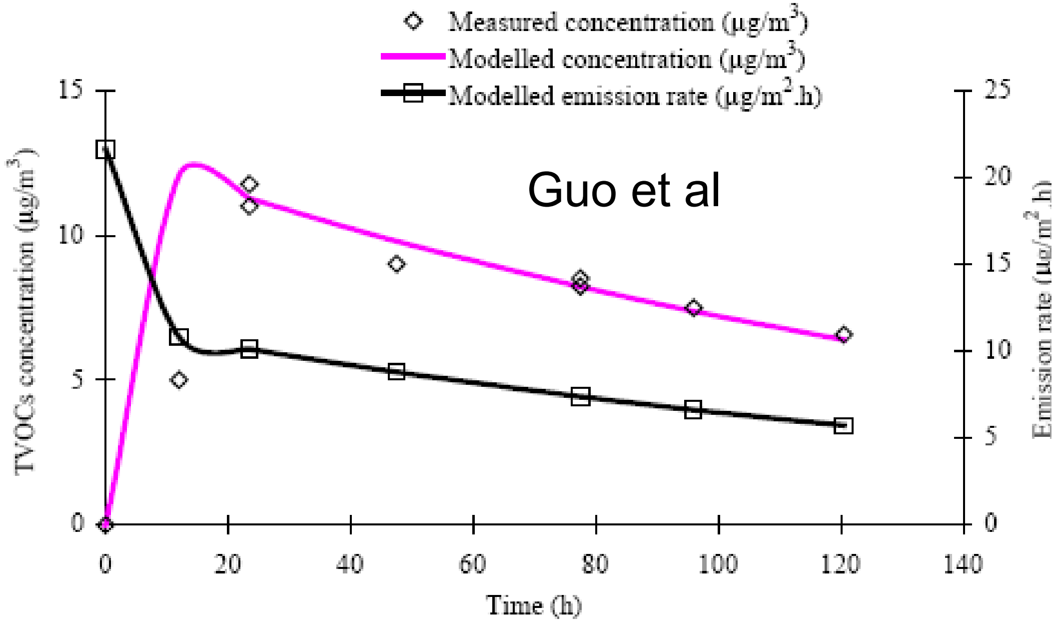


Fig. 3. The TVOCs concentration and emission rate from Dansk carpe (90% wool, 10% nylon).

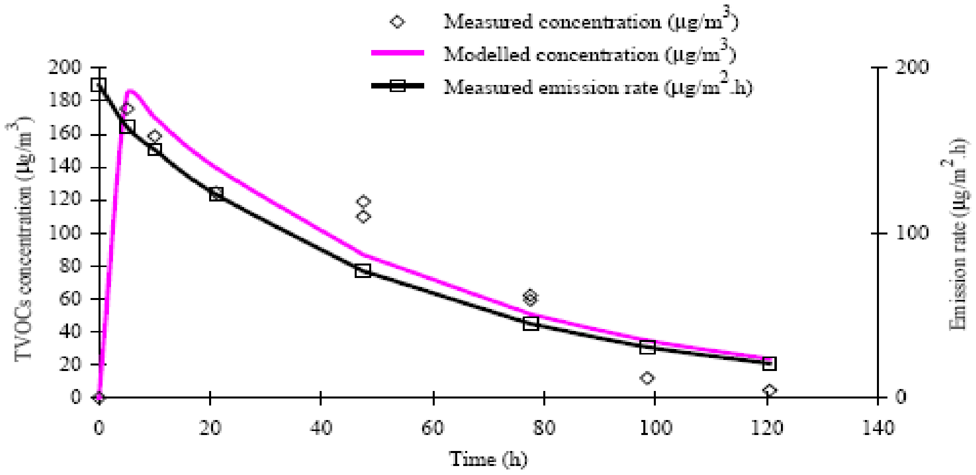


Fig. 2. The TVOCs concentration and emission rate from Super Norsk carpet.

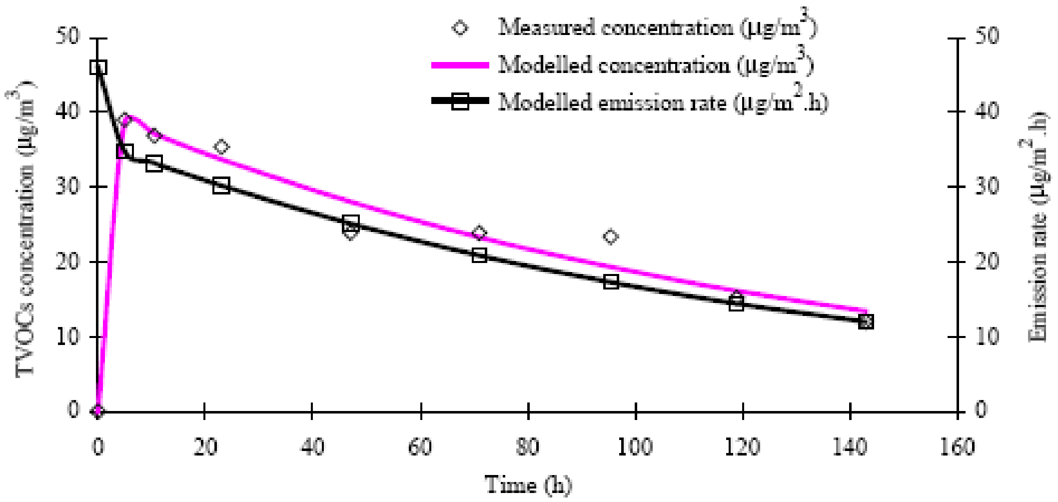


Fig. 4. The TVOCs concentration and emission rate from Clubclass carpet (100% nylon).

Furniture

Emission rate from (F) imitation leather for sofas **(28 °C)**	
Main chemicals detected	**Emission rate (μg/(m^2 h))**
Toluene	**25-34**
p-Xylene	**1-5**
2E1 H	**36-75**
DEHP	**5-42**

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Curtains

ihcp Institute for Health and Consumer Protection

Substance	Mean	Environment	Material	Comments	Source
	[µg/m²h]				
DBP	N.D.	Test Chamber	curtains	28°C	Katsumata
DEHP	4	〃	〃	28°C	〃
DBP	3	〃	〃	40°C	〃
DEHP	43	〃	〃	40°C	〃
2E1H	82	〃	insulator	28°C	〃
Diphenyl sulfone	2	〃	〃	28°C	〃
DEHP	3	〃	〃	28°C	〃
2E1H	85	〃	〃	40°C	〃
Diphenyl sulfone	2	〃	〃	40°C	〃
DEHP	16	〃	〃	40°C	〃

Research suggestions

The magnitude of emissions, the link from emissions to personal exposure, the toxicological significance of the chemicals emitted, and the costs and impacts of alternate materials should all be considered in order to evaluate potential importance of human exposures and health risks.

Exposure assessment and source apportionment of SVOCs including the flame retardants is challenging. Nevertheless, some of the most urgent research needs are in characterizing exposure pathways for these compounds

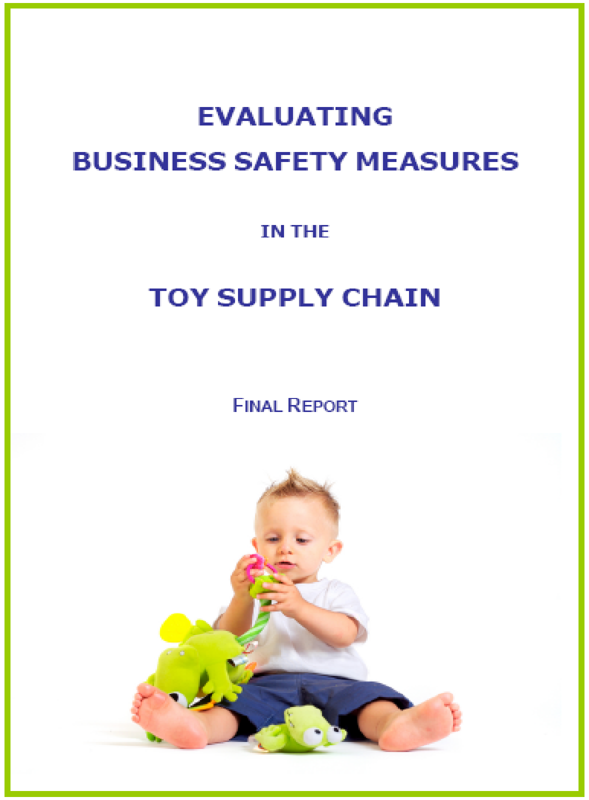
Substitution of toxic chemicals used in consumer products through green chemistry innovation efforts bears good potential for mitigating the health burden of consumer good-related emissions in the indoor air

Policy Suggestions

Think “Fitness for purpose” – towards integrated solutions for consumer protection

- Adequate product labeling
- Instructions on safe handling for consumers (with regard to indoor air emissions)
- Information campaigns to consumers for product retrofitting (especially the ones containing halogenated flame retardants).
- Harmonisation of guidelines for indoor air emissions from consumer products
- Reference laboratories for method harmonisation and reliable control – in conjunction with the RAPEX system
- Compound substitution: alternatives to flame retardants like magnesium dioxide and mixtures of it with antimony oxides, boron, melamine, melamine salts, silicon dioxide, and silicone as well as a newer class of materials known as "nano-additives" such as layered clay minerals are needed.

Key conclusions



- **Product safety cannot be guaranteed by final product testing only but needs to be embedded in the entire development and production process**
- **A strong quality and safety culture are necessary to ensure continuous attention to product safety**