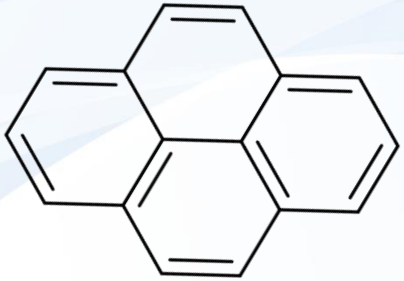
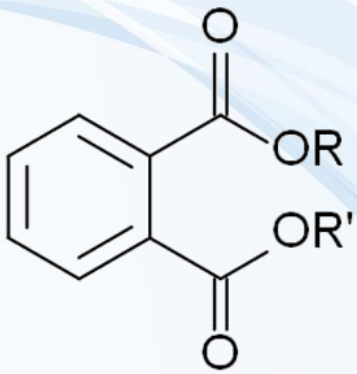
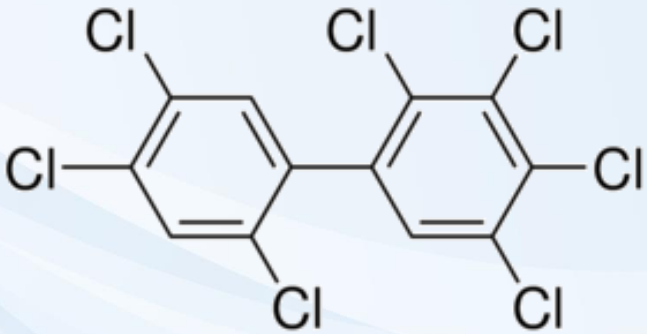
Silicone rubber – a potential passive sampler for semivolatile organic contaminants in indoor air

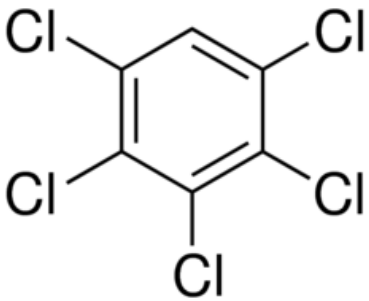
Lenka Sedlačková

IPSW 2018

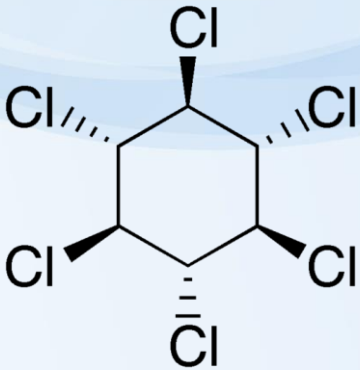


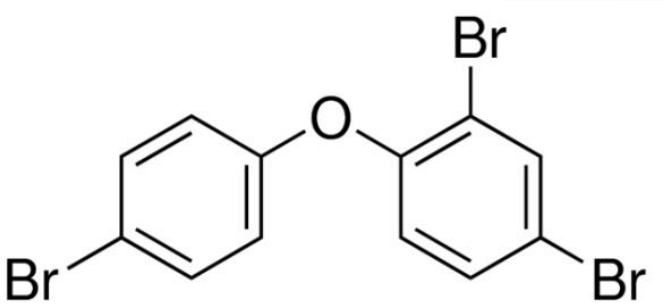


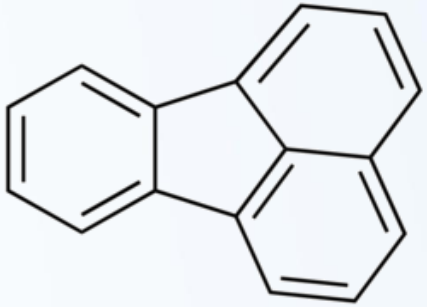


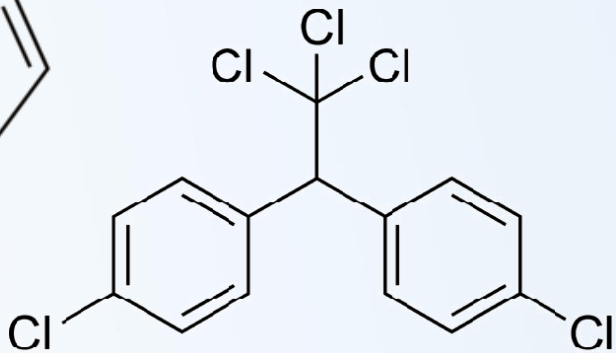


semivolatile organic compounds (SVOCs)

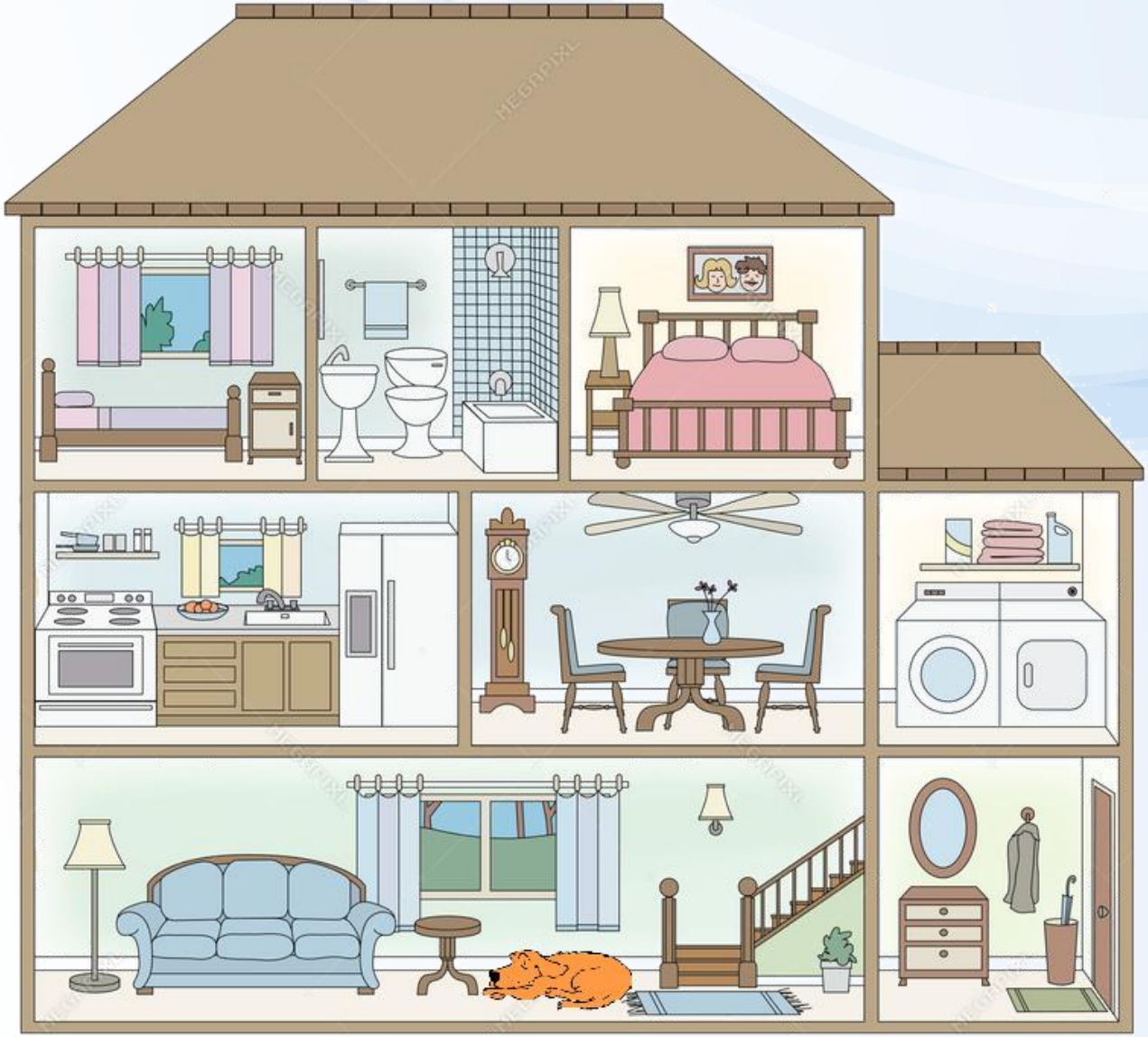






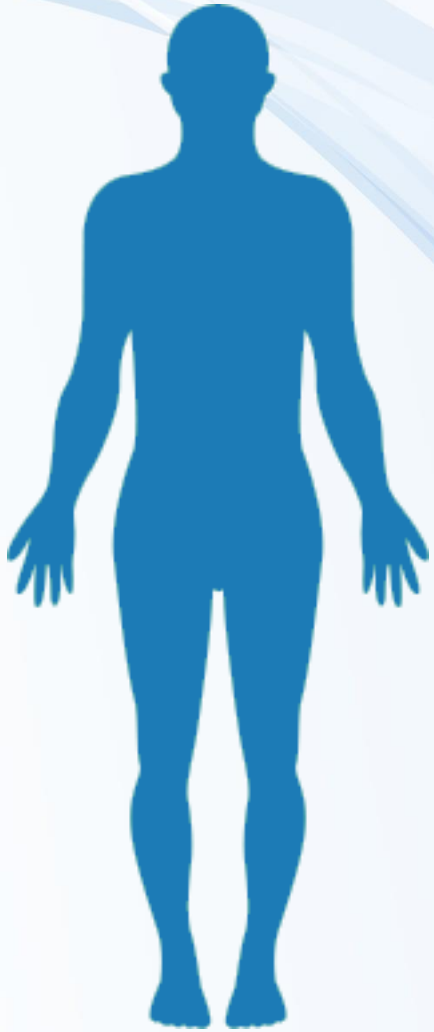


Sources of SVOCs in the indoor environment



FOOD
ingestion

AIR and DUST
ingestion
inhalation



WATER
ingestion

SOIL
dermal contact
ingestion
inhalation

http://www.cowleyweb.com/muse/anatomy/images/human.png

Toxicity of the target compounds

- formation of ROS
- carcinogenesis
- endocrine disruption
- immune suppression
- acute neurotoxicity
- impairment of reproductive system
- membrane damage

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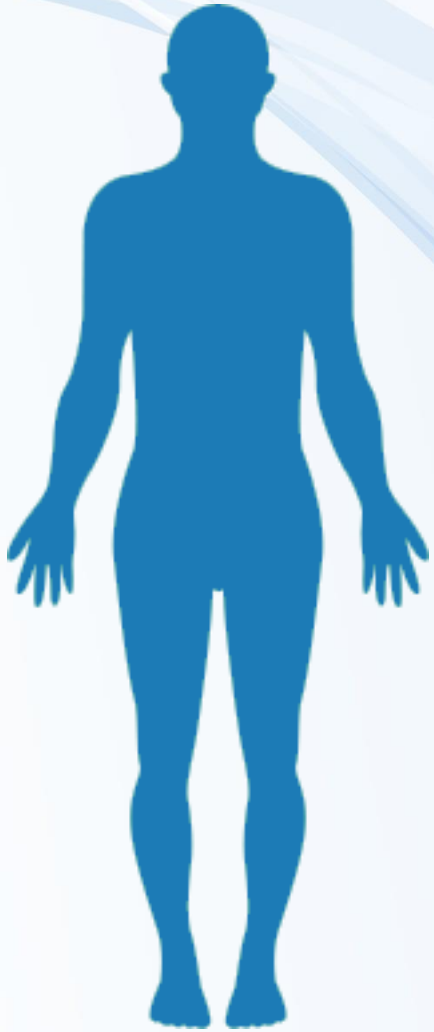

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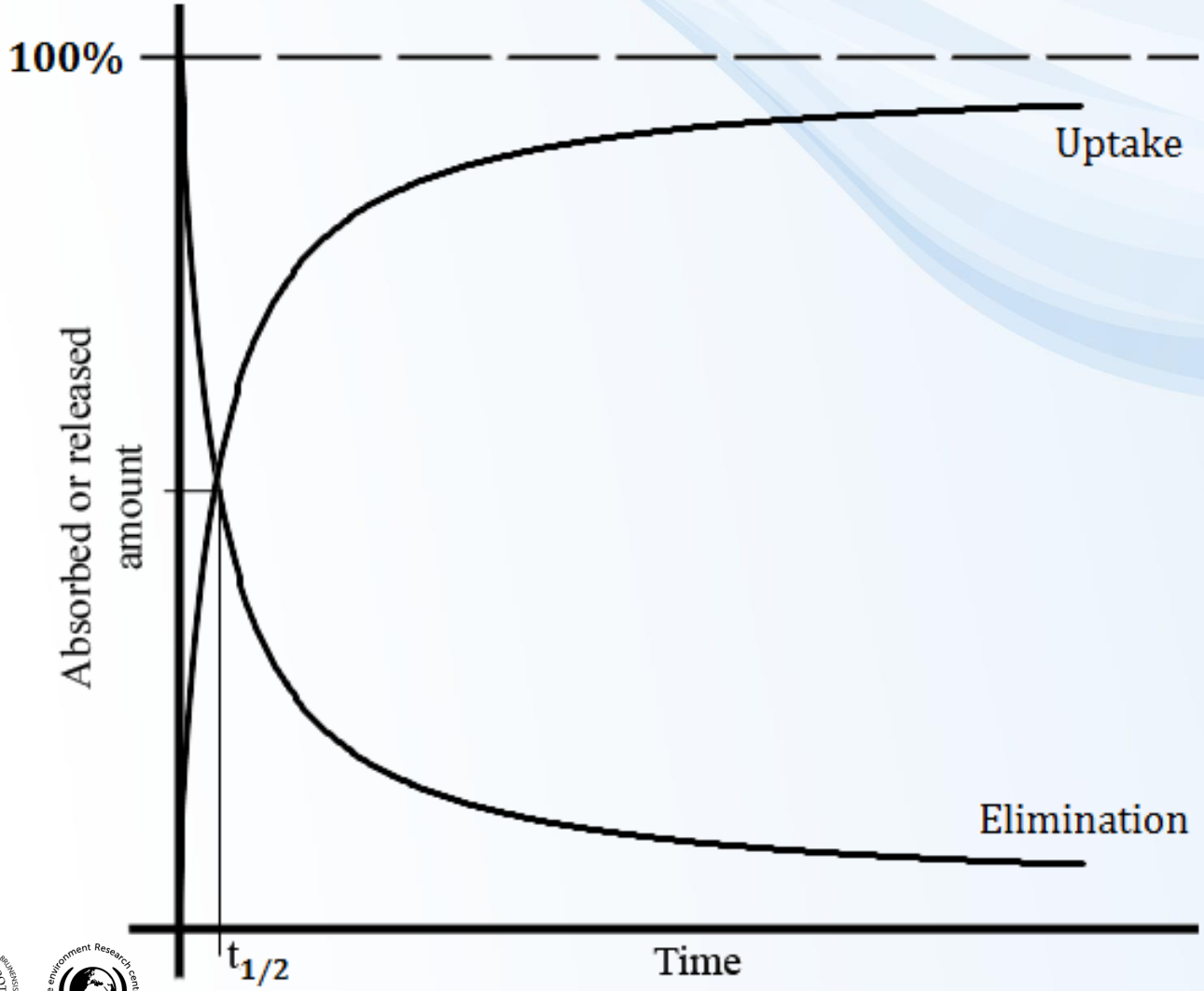
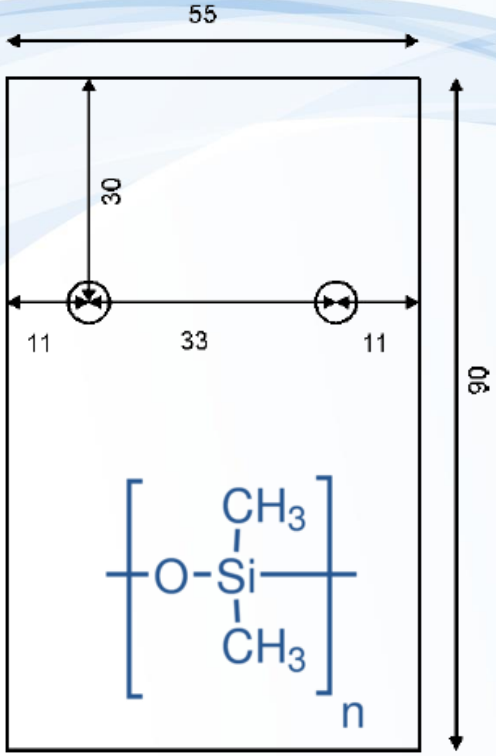
http://www.cowleyweb.com/muse/anatomy/images/human.png

Passive air sampling

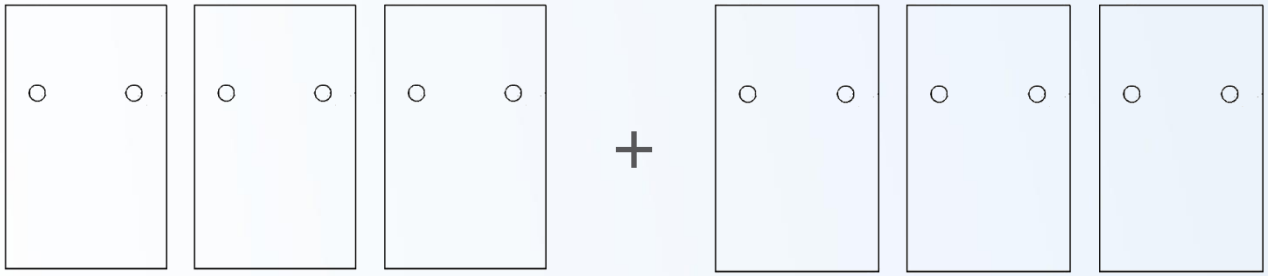


$c_{S_0}=0$
$c_{A_0}\neq 0$

$c_{S_0}\neq 0$
$c_{A_0}=0$



surface area 100 cm^2



exposed for 0, 7, 14, 21, 28, 35, 42, 49, 56 days

Low-volume active sampler

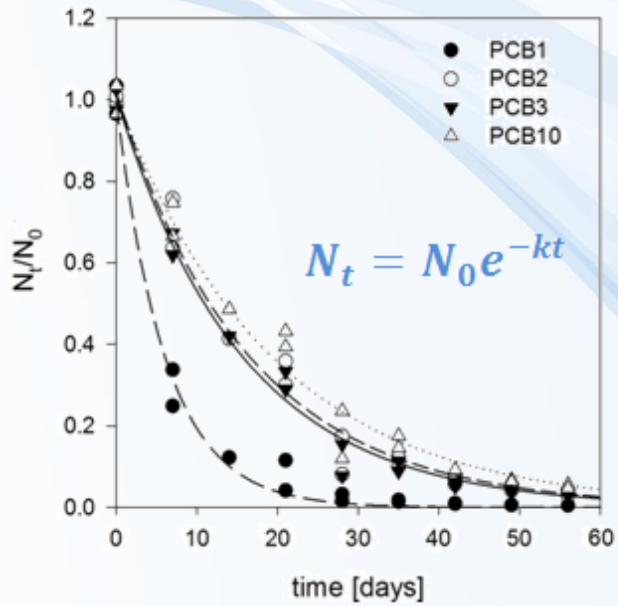
2.23 m^3/h

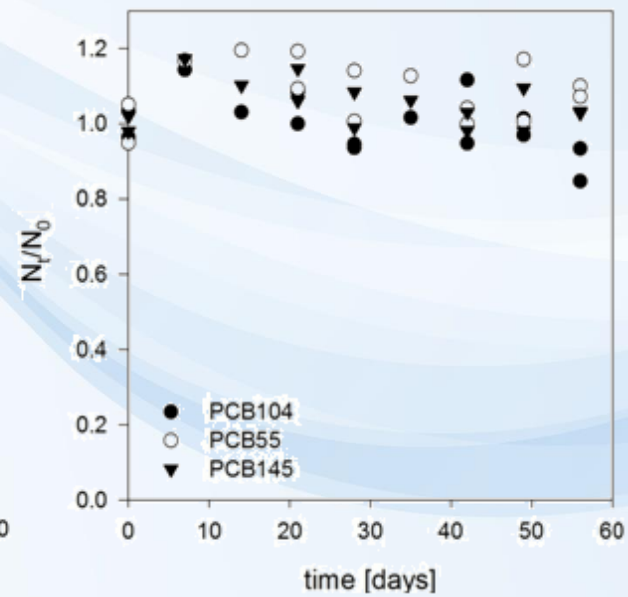
1 pm inlet

- quartz glass filter
- 2x PUF
- 7 days

Elimination kinetics of PRCs

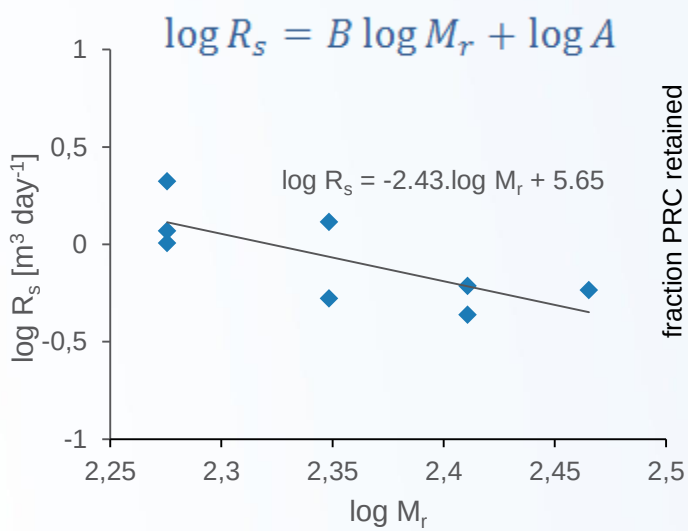
PRC	N_t/N_o	k_e [day^{-1}]
PCB 1	1.00±0.02	0.16±0.01
PCB 2	1.02±0.03	0.061±0.003
PCB 3	1.01±0.02	0.064±0.003
PCB 10	1.01±0.03	0.052±0.003
PCB 14	1.00±0.03	0.016±0.001
PCB 30	0.99±0.04	0.019±0.002
PCB 50	1.01±0.02	0.0056±0.0006
PCB 21	1.03±0.02	0.0049±0.0007
PCB 104	1.05±0.04	-
PCB 55	1.09±0.04	-
PCB 145	1.07±0.03	-
PCB 78	1.06±0.03	-
PCB 204	1.08±0.03	-

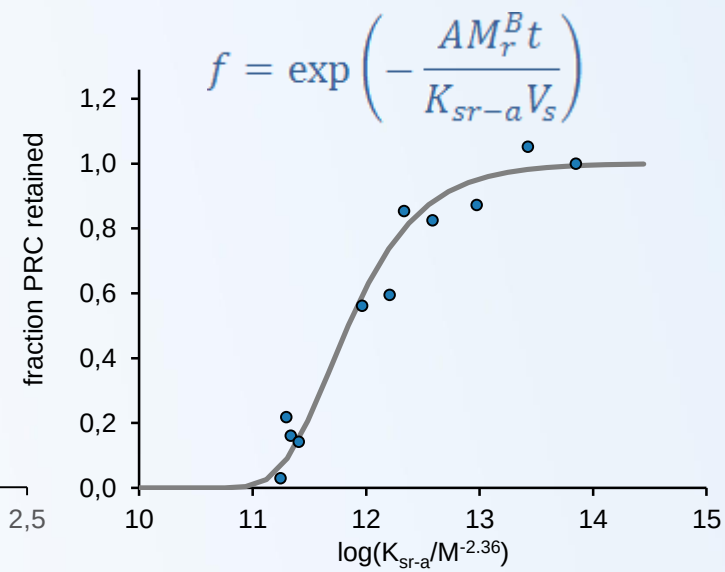




$$R_s = k_e K_{sr-a} V_s$$

$$R_s = A.M_r^B$$





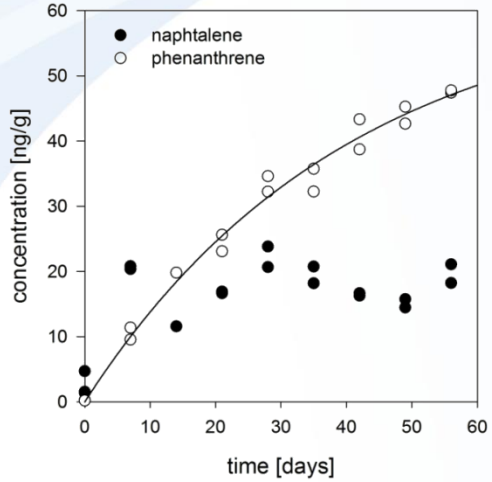
Outputs

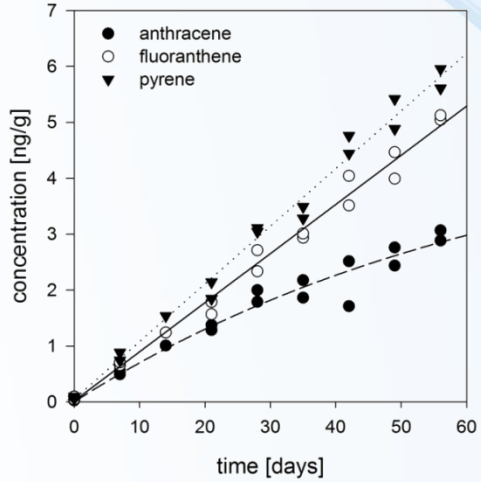
- accummulation kinetics of target compounds → curves/lines
- validation of sampling regime

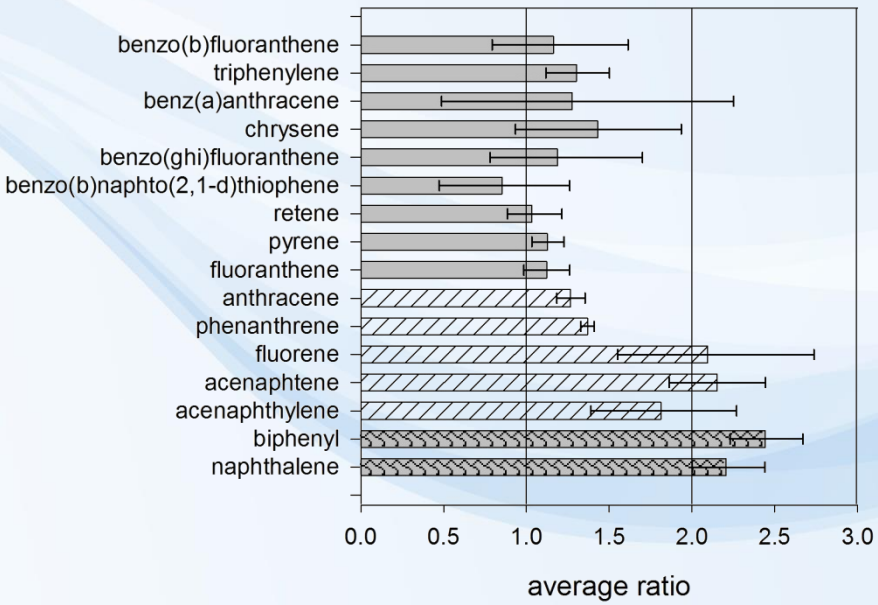
$$R = \frac{(0 \rightarrow 28) + (28 \rightarrow 56)}{56}$$

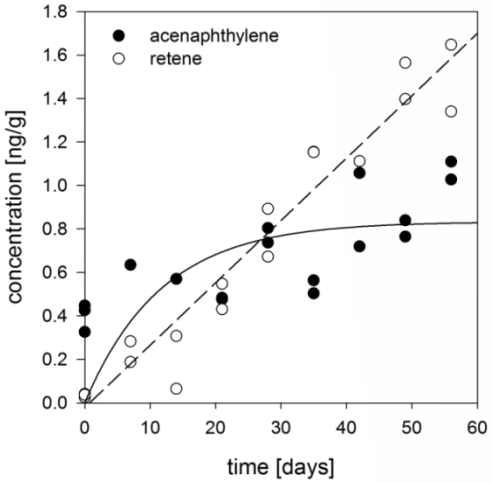
- comparison with LVAAS
  - air concentrations → grouped bar charts
  - ratio PAS vs AAS

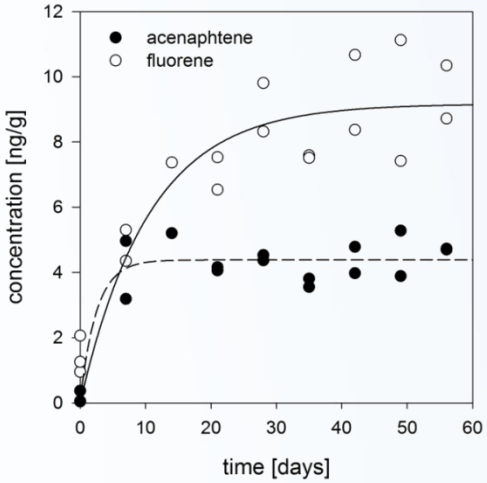
Accummulation kinetics - PAHs

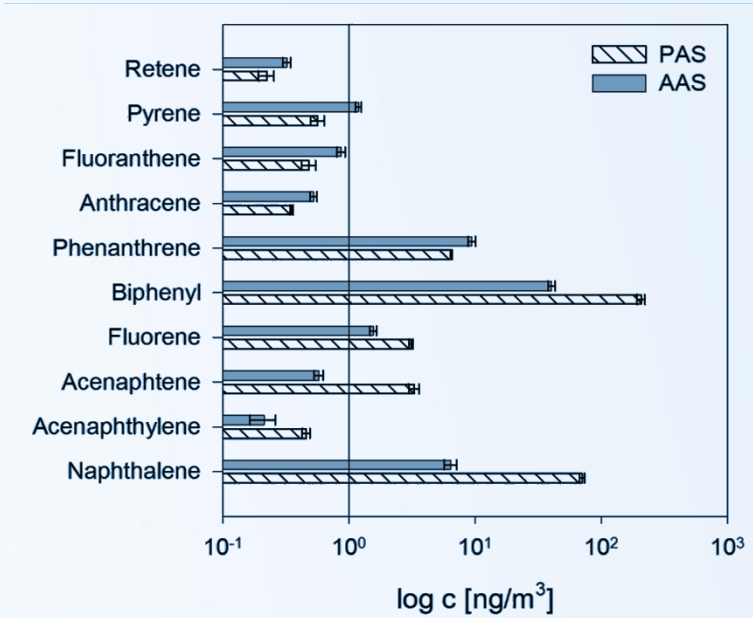




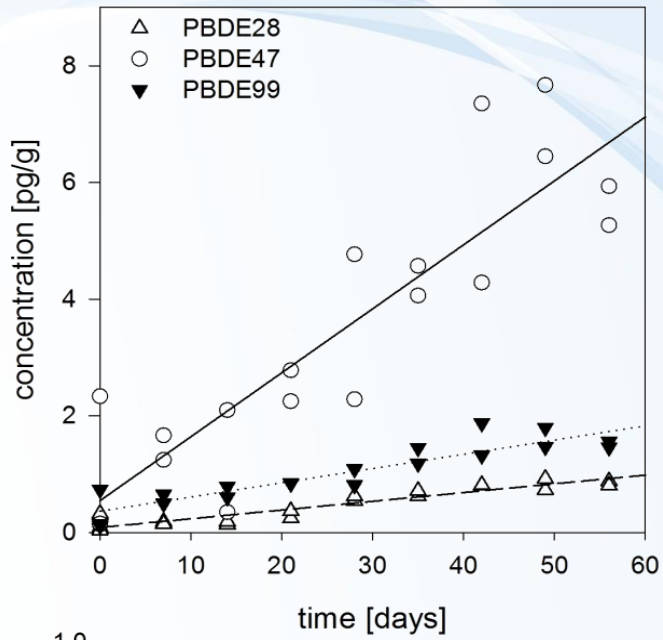


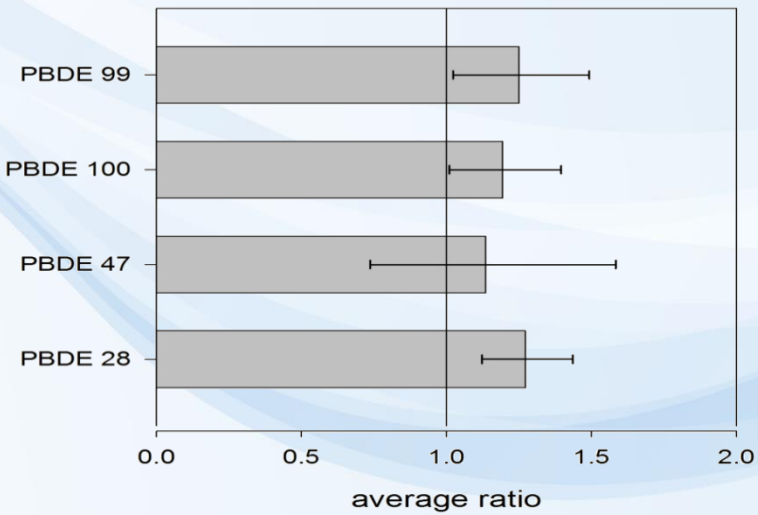


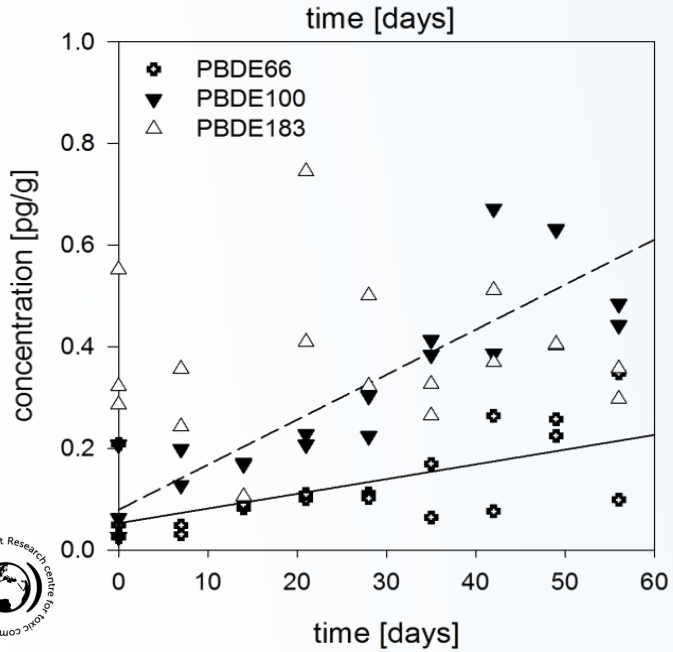


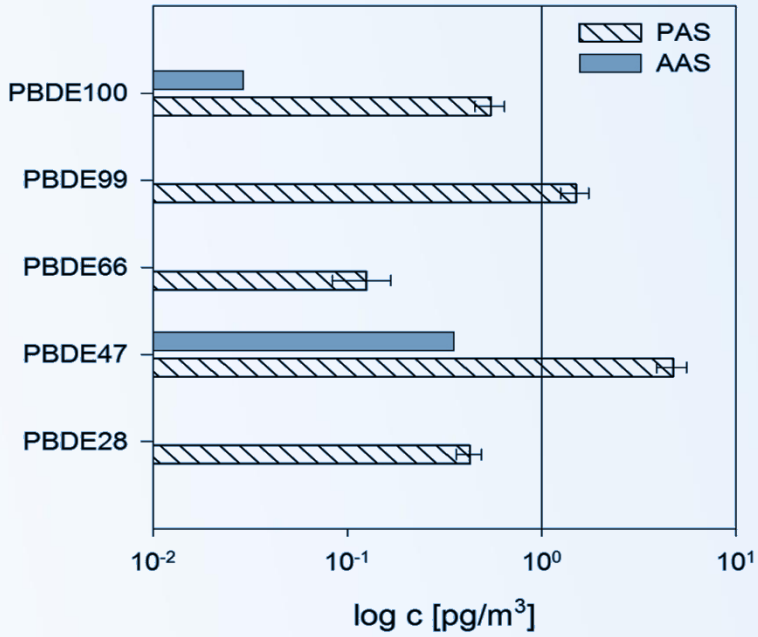


Accummulation kinetics - PBDEs

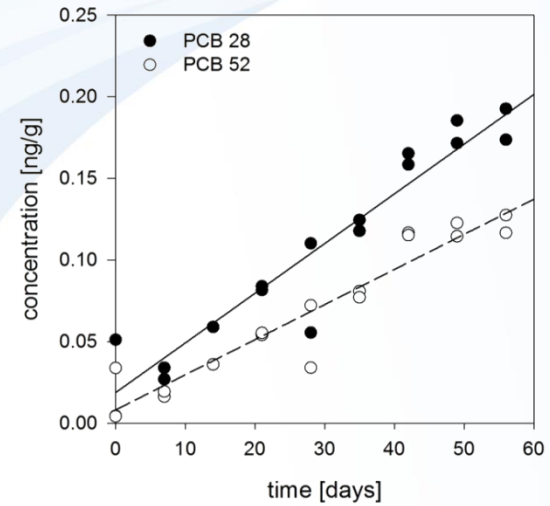


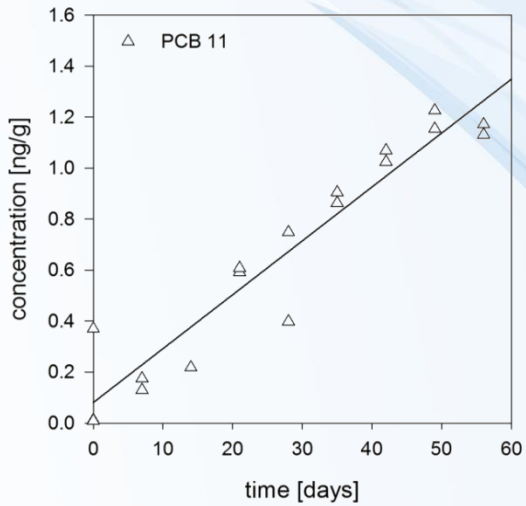


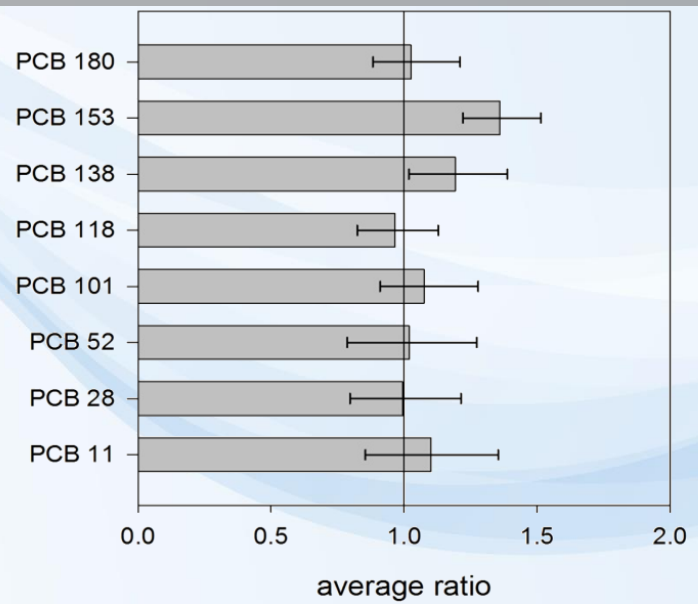


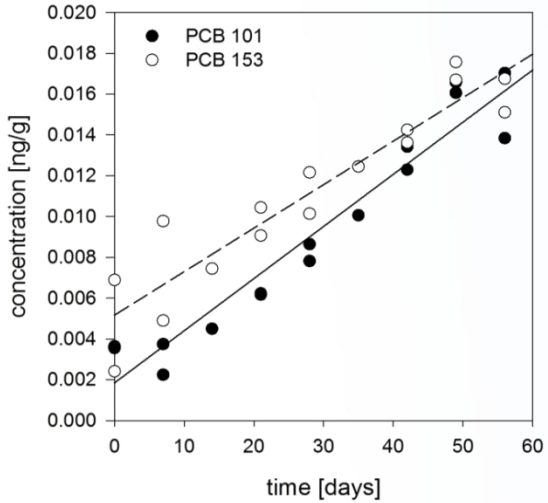


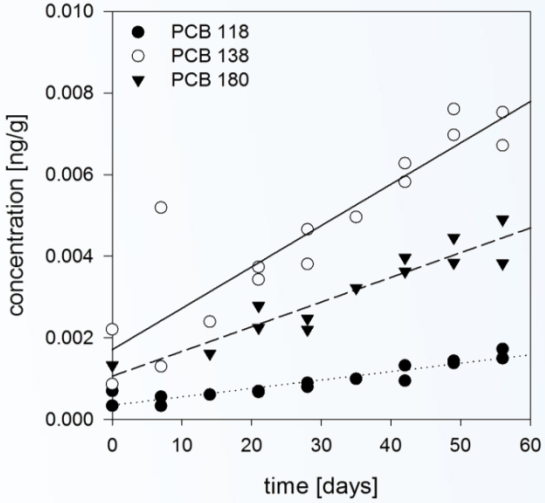
Accummulation kinetics - PCBs

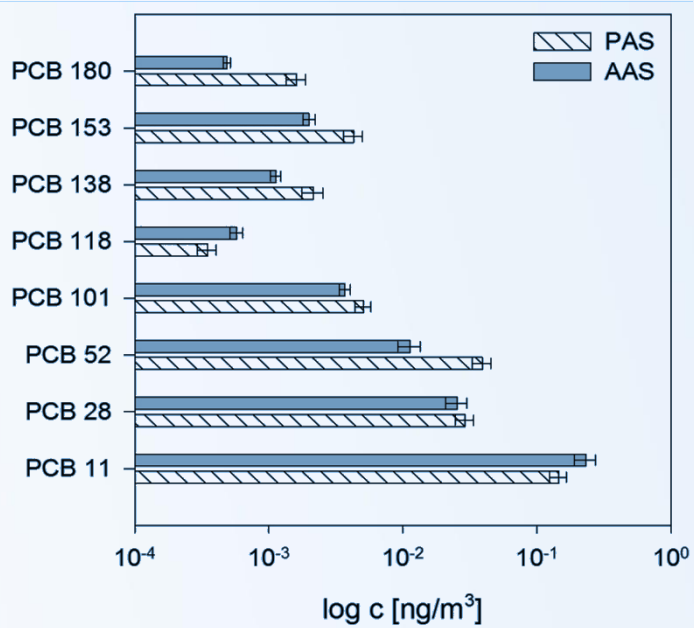




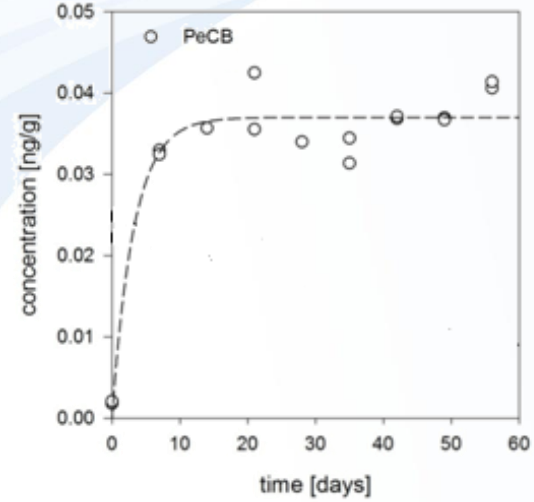


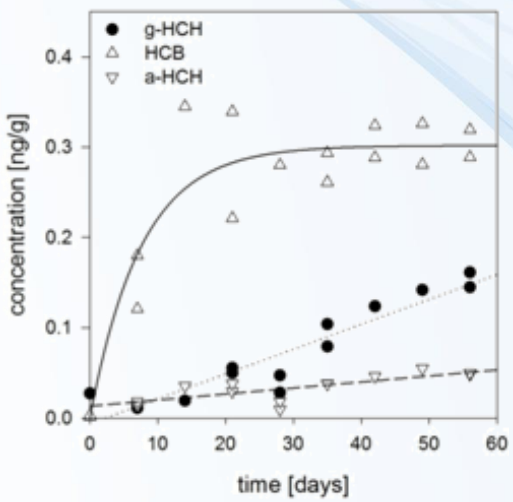


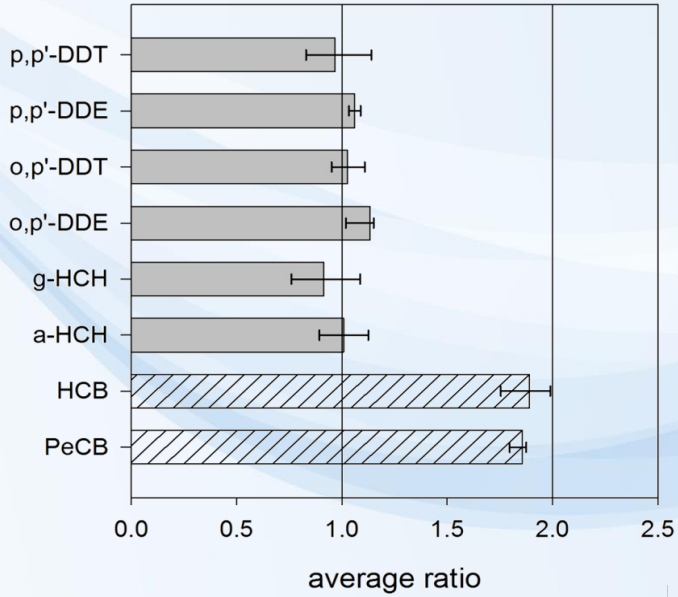


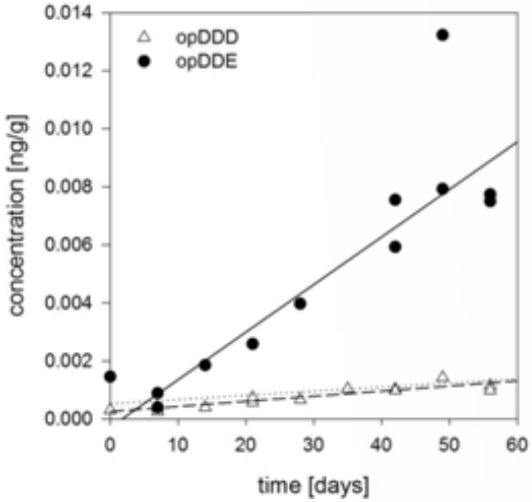


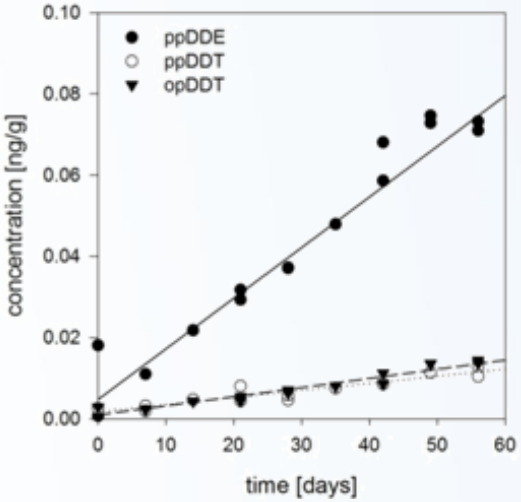
Accummulation kinetics - OCPs

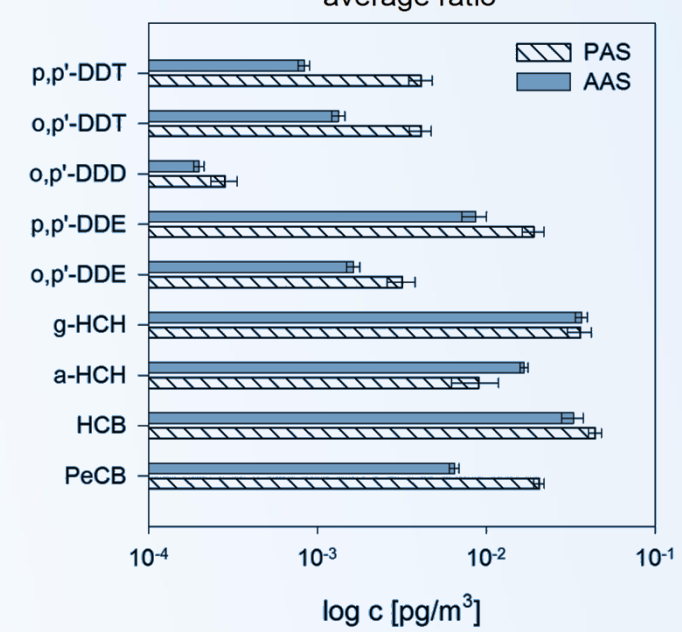






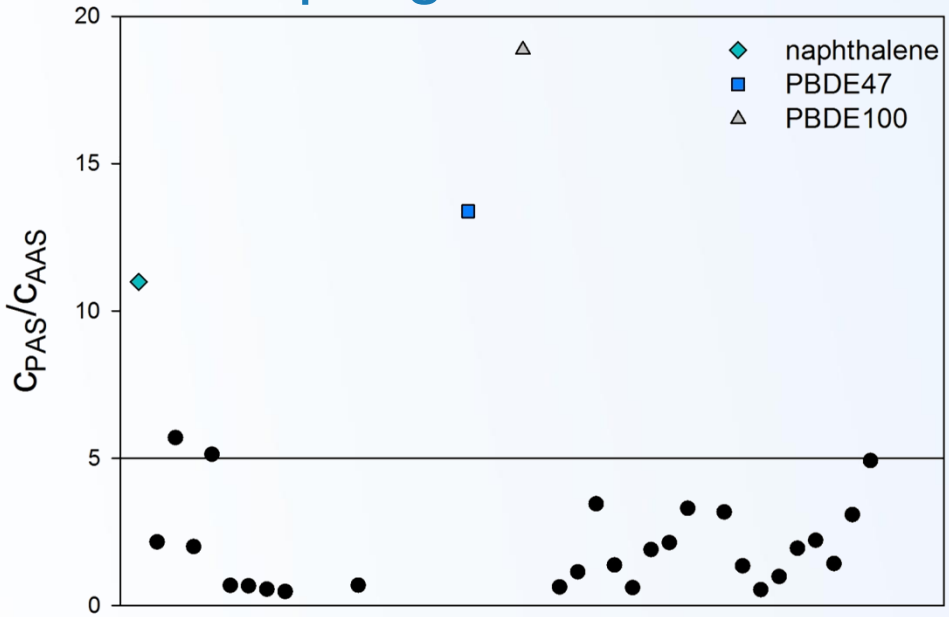






Summary

- sampling rate of the silicone rubber samplers for the target compounds was determined using calculated $K_{SR\text{-}A}$
- concentration of the contaminants obtained by the passive sampling method is comparable with results gained by active sampling



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