BROMINATED FLAME RETARDANTS IN THE INDOOR ENVIRONMENT: PHYSICAL-CHEMICAL PROPERTIES, EMISSIONS AND MODELLING APPROACHES OF INDOOR FATE

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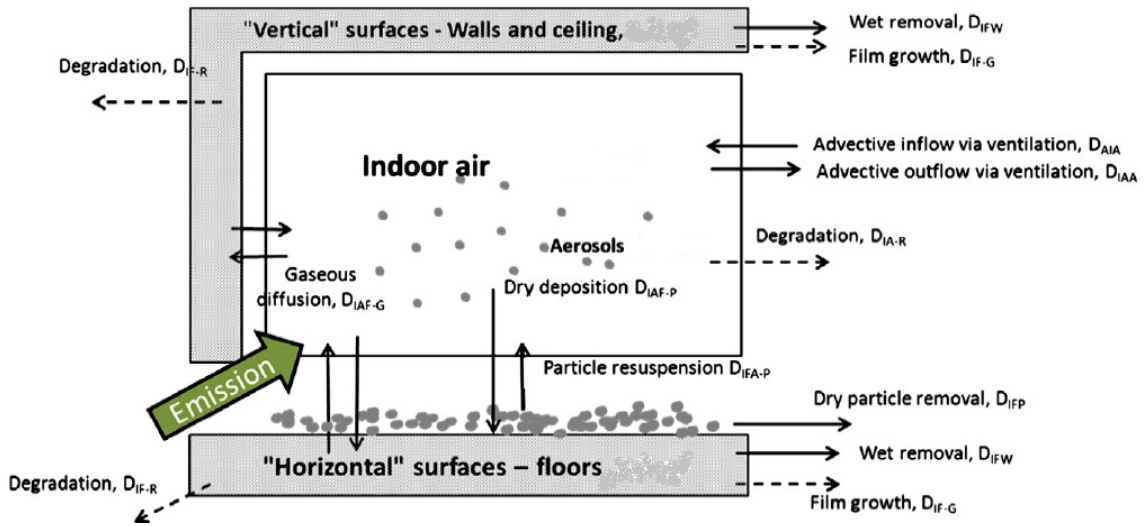
Indoor chemical fate - a modeling approach

- Multimedia, mass-balance models
- Compartments representing different zones and/or media (i.e air,interior surfaces)
- Emissions, diffusive and advective mass-transfer processes, degradation processes (indoor fate processes)

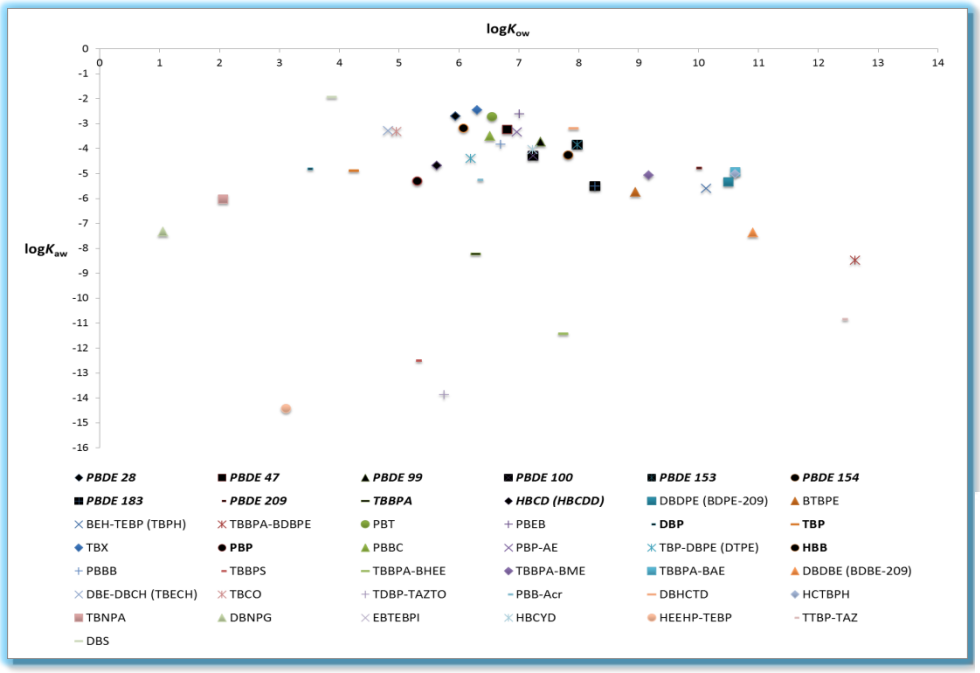


(Cousins A.P., 2012)

Basic constituents of an indoor fate model

- Physical-chemical properties of FRs (BFRs)
- Emissions from indoor sources
- Indoor fate processes

Physical-chemical properties: *impact on indoor behaviour*



$1 < logK_{ow} < 12$

$-14 < logK_{aw} < -2$

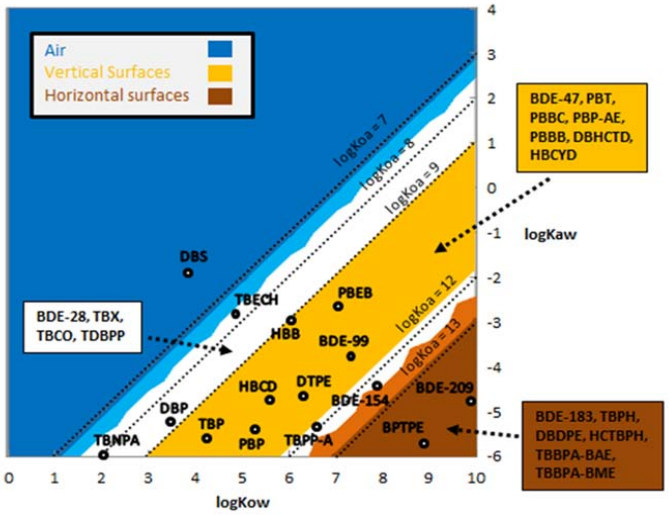
80.0%-100.0%

60.0%-80.0%

60.0%-75.0%

80.0%-100.0%

60.0%-80.0%



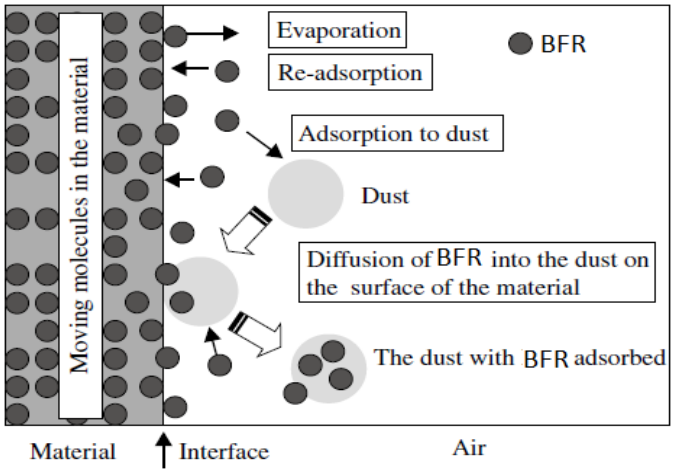
Strong partitioning to indoor surfaces (including particles)

Emissions

- Consumer products may act as sources indoors
- Limited experimental data on BFR emission rates
- Key release mechanism from treated products?

or

- Volatilisation Particle-mediated transfer (abrasion & direct diffusion)
- Current emission models **do not** account for particle emissions



Evidence that dust particles on the material surface as well abrasion-derived particles enhance chemical release!

Particle mediated transfer far more important than volatilisation for the very low volatility, highly hydrophobic compounds

Indoor fate: what do models indicate?

- Ventilation is key fate process for the more volatile compounds
- Indoor surfaces significant sinks; Implication: can act as re-emitting (secondary) sources prolonging residence time
- Fate of BFRs increasingly influenced by particle transport, with increasing degree of bromination
- Dust removal crucial for removing low-volatility compounds

What is needed?

- Experimental phys-chem. properties for the alternative BFRs
- Mechanistic description of the alternative release mechanisms
- Better understanding of BFR partitioning to indoor surfaces
- Better description of particle mass-balance indoors
- Model evaluation in well characterised indoor environments

Next steps

- i) Complete evaluative fate modelling of emerging and novel BFRs, and HFFRs.
- ii) Further development and evaluation of the chamber model (2-week secondment to Birmingham)
- iii) Develop and evaluate a modelling approach that combines emission and indoor fate modelling