Supplementary Information for

Assessing Human Exposure to Chemicals in Materials, Products and Articles:

A Modular Mechanistic Framework

Table of Contents:

1) *Nomenclature*

$A_{contact}$	Contact area between skin and sink surface (m²)
A_{exp}	Exposed body surface area (m²)
$A_{mouthing}$	Mouthed object surface area (m²)
A_s	Surface area of sink (non-source) surfaces (m²)
A_{ss}	Surface area of source surfaces (m²)
ACH	Air change rate; $ACH = Q/V$ (1/h)
AR_{source}	Application rate of source (µg/h)
bw	Body weight (kg)
C_0	Material-phase SVOC concentration (µg/m³)
$C_{a,sat}$	Saturation concentration in air (µg/m³)
C_m	SVOC concentration in clothing material (µg/m³)
$C_{o,sat}$	Saturation concentration in octanol (µg/m³)
C_{pm}	Gas-phase SVOC concentration in porous material (µg/m³)
C_s	Concentration of SVOCs on sink surfaces (µg/m²)
C_{ssl}	Concentration of SVOCs associated with skin-surface lipids (µg/m³)
C_t	Particle- and gas-phase SVOC concentration in the gas phase (µg/m³)
CR_s	Rate of contact with sink surfaces (m²/h)
d	Exposure duration (h)
D_a	Diffusion coefficient of the SVOC in air (m²/h)
D_m	Diffusion coefficient of the SVOC in clothing material (m²/h)
DI	Daily intake (µg/kg)
E	Emission rate of SVOCs from source materials (µg/(m²·h))
EF	Exposure frequency (1/h)
Ex_{cloth_d}	Dermal exposure rate to clothing (µg/h)
Ex_{dust_ing}	Dust ingestion exposure rate (µg/h)
Ex_{gas_d}	Transdermal exposure rate from the gas phase (µg/h)
Ex_{inh}	Inhalation exposure rate (µg/h)
$Ex_{mouthing}$	Mouthing exposure rate for mouthing of source (µg/h)
$Ex_{mouthing\_other}$	Mouthing exposure rate for mouthing of objects with sink surfaces (µg)
Ex_{part_d}	Transdermal exposure rate for particles adhered to exposed skin (µg/h)
Ex_{source_d}	Exposure rate for direct contact of source with the skin (µg/h)
Ex_{source_ing}	Source ingestion exposure rate (µg/h)
Ex_{surf_d}	Transdermal exposure rate for dermal contact with sink surfaces (µg/h)
F	Particle-phase concentration of SVOCs in indoor environments (µg/m³)
F_{out}	Outdoor particle-phase concentration of SVOCs (µg/m³)
f_A	Fraction of chemical available for uptake (-)
f_{om_dust}	Fraction of organic matter in dust (-)
f_{om_part}	Fraction of organic matter associated with airborne particles (-)
f_{ret}	Retention fraction of a source (-)
H	Henry's law constant (m³·Pa/mol)
$h_{m,s}$	Mass transfer coefficient for the sink (non-source) surface (m/h)
h_m	Mass transfer coefficient for the surface of a source (m/h)

IR_{dust}	Dust intake rate (g/h)
IR_{inh}	Inhalation intake rate (m³/h)
IR_{source}	Source intake rate (g/h)
j	Represents a specific SVOC out of N SVOCs (-)
J_{source_ssl}	Flux from source to skin-surface lipids (µg/(m²·h))
J_{ssl_c}	Flux from skin-surface lipids to dermal capillaries (µg/(m²·h))
k_{p_g}	Transdermal permeability coefficient from the gas phase (m/h)
k_{p_ssl}	Transdermal permeability coefficient from the skin-surface lipids to dermal capillaries (m/h)
K_{dust}	Dust/gas partition coefficient (m³/g)
K_{aw}	Air/water partition coefficient (-)
K_{ca}	Clothing/gas partition coefficient (-)
K_m	Dust/material partition coefficient (m³/g)
K_{oa}	Octanol/air partition coefficient (-)
K_{ow}	Octanol/water partition coefficient (-)
K_p	Gas/particle partition coefficient of SVOCs (m²/µg)
K_s	Sink surface/gas partition coefficient (m)
K_{ssl}	Partition coefficient between skin-surface lipids (SSL) and clothing (-)
L	Thickness of the porous material (m)
L_c	Characteristic length (m)
L_m	Thickness of clothing material (m)
M_s	Mass loading of settled dust on sink (non-source) surfaces (µg/m²)
M_{ss}	Mass loading of settled dust on source surface (µg/m²)
MR	Migration rate during mouthing (g/(m²·h))
m_x	Dust mass concentration at the depth of x (µg/m³)
n	Freundlich constant (-)
N	Number of SVOCs considered (-)
$P_{dust,s}$	Concentration of SVOCs in the dust settled on the sink (non-source) surfaces (µg/g)
P_{dust}	Concentration of SVOCs in the dust settled on the source surface(µg/g)
P_p	Size-dependent particle penetration factor (-)
p_s	Saturation vapor pressure of pure SVOCs (Pa; mmHg)
Q	Ventilation rate (m³/h)
q_{part_skin}	Transfer rate from particles adhered to skin (m/h)
R	Universal gas constant (m³·Pa/(K·T))
R_p	Size-dependent particle resuspension rate (1/h)
Re	Reynolds number
r_{uptake}	Chemical uptake rate (1/h)
S	Generation rate of particles from indoor sources (µg/h)
Sc	Schmidt Number
Sh	Sherwood Number
t	Time (h)
T	Temperature (K)
TSP	Mass concentration of total suspended particles in the room (µg/m³)
TSP_{out}	Mass concentration of total suspended particles outdoors (µg/m³)
V	Volume of the room (m³)
v_d	Size-dependent particle deposition velocity (m/h). Could be v_{dv}, v_{du}, or

	v_{dd} depending on the orientation of the surface.
v_{dv}	Size-dependent particle deposition velocity to a vertical wall (m/h)
v_{du}	Size-dependent particle deposition velocity to an upward-facing horizontal surface (m/h)
v_{dd}	Size-dependent particle deposition velocity to a downward-facing horizontal surface (m/h)
w_0	SVOC mass fraction in the source (µg/g)
w_{dust}	SVOC mass fraction in dust settled on source surfaces (µg/g)
$w_{dust,s}$	SVOC mass fraction in dust settled on sink (non-source) surfaces (µg/g)
x	Depth from the surface of the material (m)
y (or C_g)	Gas-phase concentration of SVOCs in indoor environments (µg/m³)
y_0	Gas-phase concentration of SVOCs in the layer immediately adjacent to the source (µg/m³)
Y_{out}	Outdoor gas-phase concentration of SVOCs (µg/m³)
y_s	Gas-phase concentration of SVOCs in the layer immediately adjacent to the non-source surfaces (µg/m³)
δ	Thickness of the organic film (m)
δ_0	Critical film thickness at which adsorption transforms to absorption (m)
ε	Porosity of material (-)
ρ_{dust}	Density of dust (µg/m³)
ρ_{part}	Density of airborne particles (µg/m³)
ρ_{source}	Density of source (µg/m³)

2) *List of Consensus Points*

Consensus Point 1: To address challenges posed by exposure modeling, mechanistic models are preferred. Mechanistic models are based on physicochemical principles and are thus more generalizable in contrast to empirical models. They can be selected and varied in their level of complexity based on the application. Diverse data sets and the estimation of key input parameters using structure-based or other predictive relationships can be included in mechanistic modeling approaches. It is clear that mechanistic models have to be validated, and input parameter development and validation still require good data, which often does not exist.

Consensus Point 2: The environmental compartments relevant to modeling chemical exposure indoors are the gas phase, airborne particles, settled dust and exposed indoor surfaces, including those of the occupants. Additionally, clothing exposed to indoor air can serve as exposure mediator potentially increasing or decreasing dermal uptake.

Consensus Point 3: The assumption of equilibrium between gas phase, particle phase, dust and surfaces is a prerequisite for simpler SVOC models. However, this assumption has to be treated with caution. The greater the capacity of an environmental compartment, the longer it will take for that compartment to reach equilibrium with other compartments.

Consensus Point 4: SVOC emissions are assumed to be externally controlled, thus internal diffusion is neglected and the source is considered as non-depleting. Clothing is a special case due to differences in time scales, thus internal diffusion and source depletion may be relevant.

Consensus Point 5: It is assumed that the air in the indoor environment is well-mixed. An exception might be indoor air inside closed spaces such as closets and cabinets, which should be considered separately as needed.

Consensus Point 6: For some SVOCs emitted by indoor sources, outdoor air concentrations are low and can thus be neglected in exposure assessments. In other cases, indoor and outdoor concentrations may

be comparable, thus the question of the relevance of outdoor contributions has to be taken into account and concentrations of SVOCs in the infiltrating air may have to be considered.

Consensus Point 7: Exposure can occur immediately via dermal contact with or ingestion of the source (Direct Exposure). Alternatively, emission from the source to environmental compartments occurs first, followed by transport and chemical transformations, resulting in the SVOC's presence in one or more compartments from which exposure occurs (Indirect Exposure).

Consensus Point 8: Mechanistically consistent source emission categories, derived from a continuum of sources, serve as the starting point for modeling exposure to SVOCs emitted by sources in the indoor environment. These categories are: solid, soft, frequent contact, applied, sprayed and high temperature.

Consensus Point 9: Stationary non-porous sources that are not frequently handled or touched (e.g., furniture, TVs, or vinyl flooring) have large emitting surface areas relative to the volume of most indoor environments or to the area that might come in contact with an exposed person. Exposure to SVOCs present in these solid sources mainly occurs by Indirect Exposure.

Consensus Point 10: Soft sources include cushions, mattresses, foams, carpets and clothing. Exposure to soft sources can occur both via Direct Exposure due to frequent close contact of a person to these sources and via Indirect Exposure due to their often large emitting surface areas.

Consensus Point 11: Exposure to certain SVOCs in sources that are frequently handled (e.g., electronic devices, toys) or mouthed by children (e.g., teethers) is more likely to occur via Direct Exposure. The emission category for this type of source is frequent contact.

Consensus Point 12: A liquid source that is directly applied to the body (e.g., body lotion, shampoo) is mainly linked to Direct Exposure. If the source is applied to a surface or is exposed to the indoor air (e.g., paint or detergent), Indirect Exposure dominates. Applied sources have to be considered pulse emission sources and thus require dynamic modeling approaches.

Consensus Point 13: A source that is sprayed towards the body can cause both Direct and Indirect Exposure (e.g., insect repellant). If the source is sprayed away from a person (e.g., air freshener), Indirect

Exposure contributes more. Both cases are pulse emissions and thus dynamic equations to model emission, transport and exposure are necessary.

Consensus Point 14: Combustion or heating processes such as burning a candle or cooking contribute mostly to Indirect Exposure. The relevant emission category is high temperature. This type of emission is a pulse emission that needs to include dynamic emission and chemical reactions.

Consensus Point 15: For modeling SVOC behavior in indoor environments, chemical transformations (e.g., oxidation, hydrolysis) should be discussed, even if they are not addressed quantitatively.

Consensus Point 16: Transport, partitioning and reactivity of SVOCs indoors are highly complex processes and not completely understood.

3) *Mechanistic Modeling Framework to Predict Exposure to SVOCs*
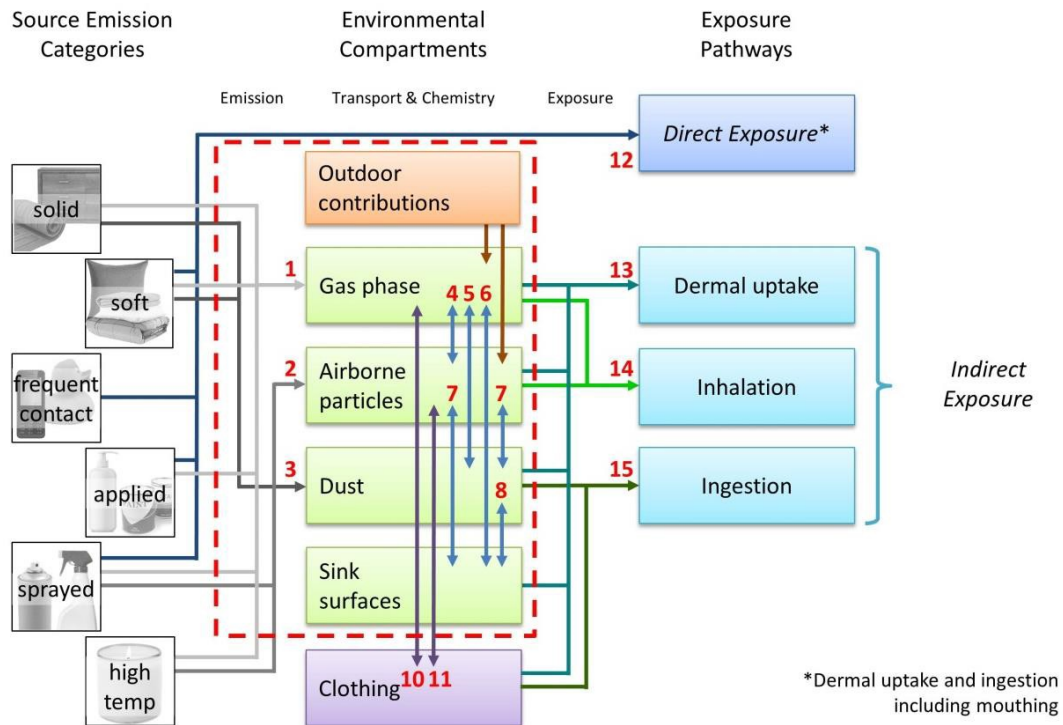

Figure S1: Dominant exposure pathways for SVOCs in indoor environments.

The red numbers refer to the equations listed below.

4) *Emission and Transport Modeling Equations*

General Note: Not all aspects of the framework have been modeled to date in a way that is appropriate

for the purpose of this framework. In these cases, the need for further model development is stated.

1. Emission into the gas phase

a.   From solid sources, soft sources, and dried liquid sources:

$$E = h_m \cdot (y_0 - y)$$

Note: It is assumed that internal diffusion is negligible.

b.   From applied sources (pulse emission):

Dynamic model, research needed

c.   From sprayed sources (pulse emission):

Model development needed

d. From high temperature sources (pulse emission):

Model development needed

2. **Emission to airborne particles**

a. From sprayed sources (pulse emission):

Model development needed

b. From high temperature sources (pulse emission):

Model development needed

3. **Emission to settled dust**

From both solid and soft sources and including emission into the gas phase:

$$E = h_m \cdot (y_0 - y) + v_d \cdot TSP \cdot P_{dust} - v_d \cdot F$$

4. **Gas/particle partitioning**

$$F = K_p \cdot TSP \cdot y$$

Note: Instant equilibrium is assumed.

5. **Dust/gas partitioning**

a. For dust settled on source surfaces:

$$P_{dust} = K_{dust} \cdot y_0$$

Note: Alternatively, partitioning between dust and source material can be described using the

dust/material partition coefficient K_m. See Liu et al. 2016[1] for details.

b. For dust settled on sink surfaces:

$$P_{dust,s} = K_{dust} \cdot y_s$$

6. **Surface/gas partitioning for sink surfaces**

a. For solid sink surfaces:

$$C_s = K_s \cdot y_s$$

b. For soft sink surfaces:

$$[\varepsilon + (1 - \varepsilon) \cdot K_s + K_{dust} \cdot m_x] \frac{\partial C_{pm}}{\partial t} = \varepsilon \cdot D_a \frac{\partial^2 C_{pm}}{\partial x^2}$$

$$C_{pm} = 0 \; for \; t = 0, 0 \le x \le L; \quad \frac{\partial C_{pm}}{\partial t} = 0 \; for \; t > 0, x = L; \quad C_{pm} = y_s \; for \; t > 0, x = 0$$

c. In the presence of an organic surface film:

$$\frac{dC_{s,j}}{dt} = h_{m,s,j} \left(y_j - \frac{C_{s,j}}{\delta \cdot K_{oa}} \right) + v_d \cdot F$$

$$\delta = \delta_0 + \sum_{j=1}^{N} \frac{C_{s,j}}{\rho_j}$$

Note: See Eichler et al. 2019[2] for further detail.

7. Mass balance for particle transport

$$V \frac{dTSP}{dt} = Q \cdot P_p \cdot TSP_{out} - Q \cdot TSP - v_d \cdot TSP \cdot (A_s + A_{ss}) + R_p \cdot M_s \cdot A_s + R_p \cdot M_{ss} \cdot A_{ss} + S$$

Change in particle mass concentration over time	Particles entering from outdoors with ventilation	Particles leaving with ventilation	Particles depositing on sink and source surfaces	Resuspension of dust from sink surfaces	Resuspension of dust from source surfaces	Particles being generated indoors

$$\frac{dM_s}{dt} = v_d \cdot TSP - R_p \cdot M_s \quad or \quad \frac{dM_s}{dt} = v_d \cdot TSP - R_p \cdot M_s$$

8. Mass balance for dust settled on sink surfaces

$$\frac{d(C_s + M_s \cdot P_{dust,s})}{dt} = h_{m,s} \cdot (y - y_s) + v_d \cdot F - R_p \cdot M_s \cdot P_{dust,s}$$

Change in SVOC concentration on sink surface and dust over time	Emission from the sink surface into the gas phase	SVOC concentration in dust deposited on sink surface	SVOC concentration in resuspended dust

9. General mass balance for indoor SVOCs

$$V \frac{dy}{dt} + V \frac{dF}{dt} = Q \cdot (y_{out} + F_{out}) - Q \cdot (y + F) + h_m \cdot A_{ss} \cdot (y_0 - y) - h_{m,s} \cdot A_s \cdot (y - y_s)$$

$$- v_d \cdot F \cdot (A_{ss} + A_s) + R_p \cdot M_{ss} \cdot P_{dust} \cdot A_{ss} + R_p \cdot M_s \cdot P_{dust,s} \cdot A_s$$

Note: If outdoor concentrations are assumed to be negligible, y_{out} and F_{out} equal 0, respectively.

Note: This mass balance does not include clothing-mediated effects.

10. Clothing/gas partitioning

a. General approach:

$$\frac{\partial C_m}{\partial t} = D_m \frac{\partial^2 C_m}{\partial x^2}$$

Boundary condition at clothing surface:

$$-D_m \frac{\partial C_m}{\partial x}\Big|_{x=L_m} = h_m \left(y - \frac{C_m}{K_{ca}}\right)$$

b. If diffusion in clothing can be ignored:

$$\frac{\partial C_m}{\partial t} = h_m \left(y - \frac{C_m}{L_m \cdot K_{ca}}\right)$$

Note: The diffusivity within the clothing material can be ignored, if the characteristic time required for clothing to reach equilibrium with the gas phase is much larger than the time required for diffusion to occur: $\frac{K_{ca}L_m}{h_m} \gg \frac{K_{ca}L^2}{D_m}$ (alternatively, if $\frac{h_m \cdot L_m}{D_m} \gg 1$).

Note: See Cao et al. 2016[3] for further detail.

11. Clothing/particle partitioning

Model development needed

5) *Exposure Modeling Equations*

Note: The exposure modeling equations (Eq. 12-15) listed below do not account for different bioaccessibilities and have thus considered worst case scenarios. However, we recommend applying bioaccessibility factors if these are available.[4, 5]

General conversion from exposure rate to daily intake:

$$DI = \frac{Ex \cdot d}{bw}$$

12. Direct Exposure

a. Dermal uptake via direct contact with a source:

Transfer from a solid source to skin surface: $Ex_{source\_d} = J_{source\_ssl} \cdot A_{contact}$

Transfer from liquid source to skin surface: $Ex_{source\_d} = w_0 \cdot AR_{source} \cdot f_A \cdot f_{ret}$

Note: See Huang et al. 2017[6], CHAP 2014[7] and Wormuth et al. 2006[8] for example approaches.

Transfer from skin surface to dermal capillaries: $J_{ssl\_c} = C_{ssl} \cdot k_{p\_ssl}$

b. Ingestion of a source:

$$Ex_{source\_ing} = w_0 \cdot IR_{source}$$

c. Mouthing of a source:

$$Ex_{mouthing} = w_0 \cdot A_{mouthing} \cdot MR \cdot EF \cdot f_A \cdot d$$

13. Dermal uptake

a. From the gas phase to dermal capillaries:

$$Ex_{gas\_d} = C_g \cdot k_{p\_g} \cdot A_{exp}$$

Note: See Weschler and Nazaroff 2014[9] for the calculation of k_{p_g}.

Note: See Gong et al. 2014[10] and Morrison et al. 2016[11] for a dynamic modeling approach.

b. From airborne particles or dust particles:

$$Ex_{part\_d} = F \cdot A_{exp} \cdot q_{part\_skin} \cdot f_A$$

Note: See Wormuth et al. 2006[8] and Giovanoulis et al. 2018[12] for values of f_A.

Note: F should be replaced by $P_{dust,s}$ for dust from sink surfaces and by $P_{dust,s}$ for dust from source surfaces.

c. From sink surfaces:

$$Ex_{surf\_d} = C_s \cdot CR_s \cdot f_A$$

d. From clothing:

$$Ex_{cloth\_d} = C_{ssl} \cdot k_{p\_ssl} \cdot A_{exp}$$

$$C_{ssl} = K_{ssl} \cdot C_m$$

Note: See Morrison et al.[13] and Cao et al. 2018[14] for more detail. Eq. 13d is based on the assumption that the skin-surface lipids (SSL) are in equilibrium with the clothing. This is likely not the case for

many SVOCs because the timescale for reaching equilibrium[15] is often longer than the duration of contact between clothing and the skin-surface lipids. Thus, this equation describes a worst case scenario.

14. Inhalation

Inhalation of gas phase and airborne particles:

$$Ex_{inh} = C_t \cdot IR_{inh}$$

$$\text{with } C_t = C_g + F$$

15. Ingestion

a. Ingestion of dust:

$$Ex_{dust\_ing} = w_{dust} \cdot IR_{dust}$$

Note: For dust from sink surfaces, w_{dust} should be replaced by $w_{dust,s}$.

Note: w_{dust} can be approximated with f_{om_dust}.

b. Mouthing of objects/exposed clothing and hand-to-mouth:

See 13c. f_A might vary.

Note: Empirical equations available in Isaacs et al. 2014[16] and Huang et al. 2017[6].

6) *Estimation Approaches for Model Parameters*

I. Saturation vapor pressure (p_s)

Antoine equation (A, B, C are substance-specific coefficients)[17]:

$$\log(p_s) = A - \frac{B}{C + T}$$

Note: See Vyazovkin, Koga, and Schick 2018[18] for an overview of experimental methods to determine the vapor pressure of chemicals with different volatilities. Wu et al. 2016[19] developed a method to measure vapor pressure for SVOCs.

II. Octanol/air partition coefficient (K_{oa})

$$K_{oa} = \frac{K_{ow}}{K_{aw}} = \frac{K_{ow} \cdot R \cdot T}{H}$$

Relationship between p_s and K_{oa}:

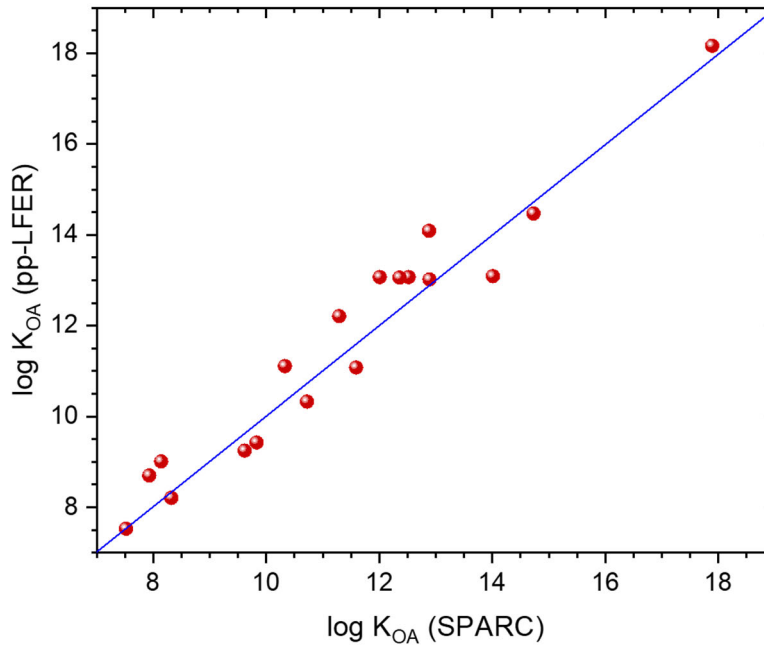$$K_{oa} = \frac{C_{o,sat}}{p_s/(RT)} = \frac{C_{o,sat}}{C_{a,sat}}$$

Figure S2: Comparison of K_{oa} values calculated by SPARC (ARChem) and the poly-parameter

Linear-Free-Energy-Relationship (pp-LFER)[20] (LSER Database). The compounds in ascending order of K_{oa}

(SPARC) values are DMP, DiBA, DnBA, DEP, DiBP, DnBP, TPP, DPP, DEHA, BBzP, TEHP, DINA, DEHTP,

DINCH, DEHP, DINP, DPHP, and TOTM.

III. Gas-phase concentration immediately adjacent to the source (y_0)

General relationship between y_0, p_s, and C_0:

$$y_0 = \gamma \cdot w_0 \cdot p_s$$

$$\text{with } w_0 = \frac{C_0}{\rho_{product}}$$

For phthalates and phthalates alternatives (Eichler et al. 2018[21]):

$$y_0 = 3.70 \cdot w_0 \cdot p_s$$

For phthalates and organophosphate flame retardants (Liang et al. 2018[22]):

$$y_0 = 3.405 \cdot w_0 \cdot p_s$$

IV.   **Mass-transfer coefficient (h_m)**

$$h_m \text{ or } h_{m,s} = Sh \cdot \frac{D_a}{L_c}$$

$$Sh = 0.664 \cdot Re^{\frac{1}{2}} \cdot Sc^{1/3}$$

Note: This estimation of h_m and $h_{m,s}$ uses the correlations in Axley 1991[23]. Typically, the average air velocity across interior surfaces is in the range of 0.01-0.16 m/s as reported by Huang et al. 2004[24]. This value could be an underestimation, thus specific air velocity and characteristic lengths should be selected when estimating the mass transfer coefficient for particular indoor cases.

V.   **Gas/particle partition coefficient (K_p)**

Definition (Pankow 1994[25]):

$$K_p = \frac{F/TSP}{C_g}$$

Extended by Finizio et al. 1997[26]:

$$K_p = \frac{f_{om\_part} \times K_{oa}}{\rho_{part}}$$

$$\log(K_p) = \log(K_{oa}) + \log(f_{om\_part}) - 11.91$$

Another method (Naumova et al. 2003[27], regression based on PAH data in atmosphere with PM$_{2.5}$):

$$\log(K_p) = -0.860 \log(p_s) - 4.67$$

See Salthammer and Schripp 2015[28] and Salthammer and Goss 2019[20] for more information on the determination of K_p.

VI.   **Dust/gas partition coefficient (K_{dust})**

$$K_{dust} = \frac{P_{dust}}{C_g} = \frac{f_{om\_dust} \times K_{oa}}{\rho_{dust}}$$

VII.   **Non-source surface/gas partition coefficient (K_s)**

a. Wood floors, ceiling and walls, and furniture (Xu et al. 2009[29], regression for phthalates):

$$\log(K_s) = -0.779 \log(p_s) - 1.93$$

b. Windows, mirrors, tile and ceramic fixtures:

Freundlich isotherm fitted by Xu and Little (2006)[30] for DEHP: K_s = 3800, n = 1.5

c. Carpet (Xu et al. 2009[29], regression for phthalates):

$$\log(K_s) = -0.627 \log(p_s) - 1.08$$

d. Stainless steel (Liang et al. 2018[31]):

Freundlich isotherm fitted for TCEP: K_s = 31.6, n = 0.24

Freundlich isotherm fitted for TCPP: K_s = 67.1, n = 0.26

e. Polyurethane foam (Liang et al. 2019[32]) depending on the temperature:

For TCEP: $K_s = 2 \cdot 10^{-18} \cdot T^{0.5} \cdot e^{17335/T}$

For TCIPP: $K_s = 2 \cdot 10^{-16} \cdot T^{0.5} \cdot e^{15468/T}$

f. See also Liu et al. 2014[33] and Liu et al. 2016[34] for K_s values for polychlorinated biphenyls (PCBs) and organophosphorus flame retardants (OPFRs) for a variety of materials.

VIII.   Gas/clothing partition coefficient (K_{ca})

a. See Morrison et al. 2018[35] for gas/clothing partition coefficients for PCBs in cotton and polyester, and in blends of polyester, cotton, viscose/rayon, and/or elastane.

b. See Cao et al. 2016[3] for gas/clothing partition coefficients for diisobutyl phthalate (DiBP), di-n-butyl phthalate (DnBP), and bis(2-ethylhexyl) phthalate (DEHP) in cotton clothing.

c. See Morrison et al. 2015[36] for gas/clothing partition coefficients for diethyl phthalate (DEP) and DnBP in cotton clothing.
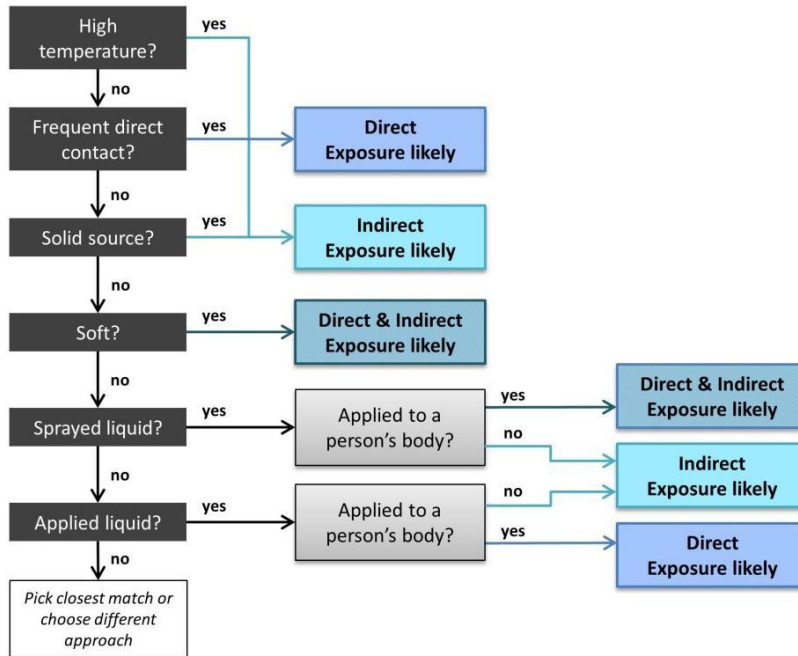
7) *Decision Tree*

Figure S3: Decision tree for exposure mechanism selection based on source emission category.

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