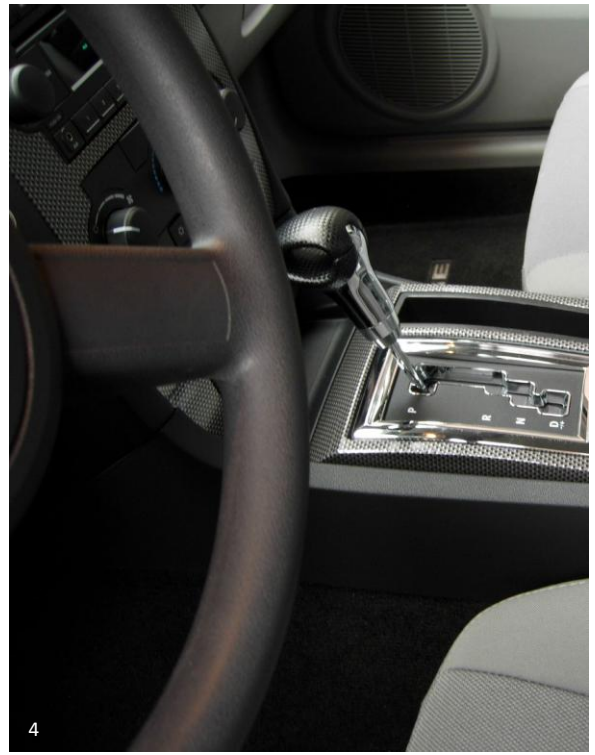

From Workers to Consumers: Adding a Service Life Module to ProScale

Pernilla Andersson, Stathis Reppas, Amanda Lundberg, Rosella Telaretti Leggieri, Therese Kärnman, Erwan Saouter and Tomas Rydberg

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What is ProScale?

- Risk-based and life cycle-oriented approach for assessment of chemicals
- ProScale consortia*
- Idea: Capture toxicological exposure potential from direct exposure to hazardous substances along the entire life cycle of a product, by describing inherent toxicity via a hazard score and the exposure potential.
- Current modules includes workers and environment

ProScale

*Originally BASF, Covestro, Deutsche Bauchemie, DSM, IVL Swedish Environmental Research Institute, Kingspan and Solvay

**Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

ProScale Service Life

$$ProScale = \sum_{\substack{Substances \\ Exposure\ routes \\ Archetypal\ environments}} \left(\frac{HF \times PPDD \times PHF}{m_{ref}} \right) \times MF$$

CF

HF: Hazard Factor (unitless)
PPDD: Per Person Daily Dose ($mg \cdot person^{-1} \cdot day^{-1}$)
PHF: Person-Hour Factor (person-days)
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Hazard Factor, HF

The HF describes the health hazard, per exposure route, of a substance based on:

- Hazard phrases (H-phrases) as in the Globally Harmonised System (GHS) and the EU CLP regulation*, which have been grouped into hazard classes which has a numerical value
- Occupational Exposure Limits (OELs) or if not available, Derived No Effects Levels (DNELs). In ProScale the OELs/DNELs reflect the potency of a substance.

ProScale hazard class	CLP hazard categories		Hazard factor (HF_e)	Route
E (10 000 - 100 000)	EUH440	Accumulates in the environment and living organisms including in humans	100 000	O,D,I
	EUH441	Strongly accumulates in the environment and living organisms including in humans	100 000	O,D,I
	EUH380	May cause endocrine disruption in humans	100 000	O,D,I
	H360	May damage fertility or the unborn child (all routes)	100 000	O,D,I
	H350	May cause cancer (all routes)	100 000	O,D,I
	H340	May cause genetic defects (all routes)	100 000	O,D,I
D (1000 - 10 000)	EUH381	Suspected of causing endocrine disruption in humans	10 000	O,D,I
	H372	Causes damage to organs through prolonged or repeated exposure (all routes)	10 000	D
	H372	Causes damage to organs through prolonged or repeated exposure (all routes)	10 000	O,D,I
	H362	May cause harm to breast-fed children (all routes)	10 000	O,D,I
	H361	Suspected of damaging fertility or the unborn child (all routes)	10 000	O,D,I
	H351	routes)	10 000	O,D,I
	H341	Suspected of causing genetic defects (all routes)	10 000	O,D,I
		May cause allergy or asthma		

Excerpt of the revised ProScale hazard banding.
To be officially released during 2026.

*Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures (CLP Regulation)

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Per Person Daily Dose, PPDD

In ProScale Workers exposure is captured via the ECETOC Targeted Risk Assessment (TRA) model, thus for the service life the ECETOC Consumer TRA model was selected to capture exposure.

Benefits Consumer TRA:

- Covers a wide scope of Product and Article Categories (PCs, ACs)
- Uses minimal input to suit the needs for ProScale Service Life (Pvap, Product Ingredient Fraction by Weight)
- Daily systemic exposure estimates (mg/kg/day, mg/m3) for each exposure route.

DEFAULT VP (non-spray)					
CLASSES		Default Vapour Pressure Band (non-spray)	Default fraction released to air		
A		A: Vapour pressure >= 10 Pa	1		
B		B: Vapour pressure between 1 and 10 Pa	0.1		
C		C: Vapour pressure between 0.1 and 1 Pa	0.01		
D		D: Vapour pressure < 0.1 Pa	0.001		
Vapour Pressure (Pa)					
Reference Value (Inhalation)		mg/m^3			
Reference Value (Inhalation)		mg/kg/day			
Reference Value (Dermal)		mg/kg/day			
Reference Value (Oral)		mg/kg/day			
Molecular weight		g/mol			
Saturated vapour concentration (SVC)	0.00E+00	mg/m3			
	Use "x" only		Use "x" only		
Descriptor	Select Use by Sentinel Product	Product Subcategory	Select Use by Product Subcategory	Product is a spray	Product Ingredient Fraction by Weight

Source: ECETOC Consumer TRA Excel-spreadsheet. Available from: ECETOC website

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Person-Hours Factor, PHF, and Archetypal Indoor Environments, AIEs

The PPDD represents the daily exposure per person, the person-hour factor (PHF) is used to capture the exposure of all consumers in an archetypal indoor environment (AIE) and the functional unit time horizon.

AIEs are derived based on e.g. normative building standards and recommendations for different indoor environments.

$$PHF = \text{People Density (persons/m²)} \times \text{Environment Surface Area (m²)} \times \text{Time Per Person Year (days/year/person)} \times \text{Functional Unit Horizon (years)}$$

People Density (persons/m²)	Environment Surface Area (m²)	Time Per Person Year (days/year/person)
Office: 0.1	Office: 100	Office: 220
Household: 0.04	Household: 50	Household: 330
Car: 0.2	Car: 6	Car: 150

Product system dependent

AIE specific

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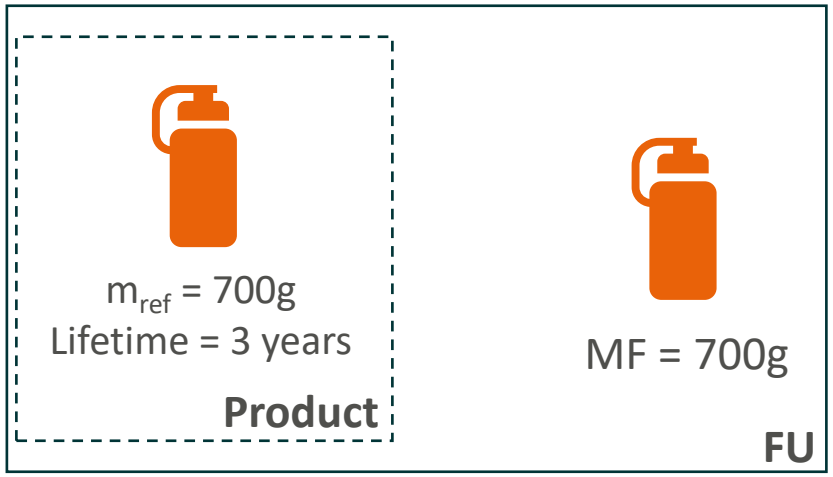
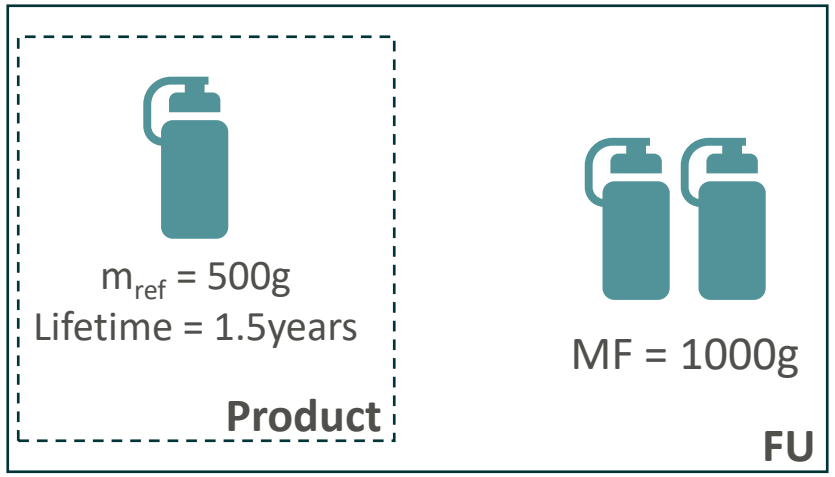
Mass Flow, MF, and Reference – Flow Mass, m_{ref}

The mass flow (MF) captures the total mass products required to fulfill the FU horizon, while the reference-flow mass (m_{ref}) represents the mass of a single product.

Example: Two bottles in different materials during 3 years





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Monte Carlo Analysis of Variable Contributions

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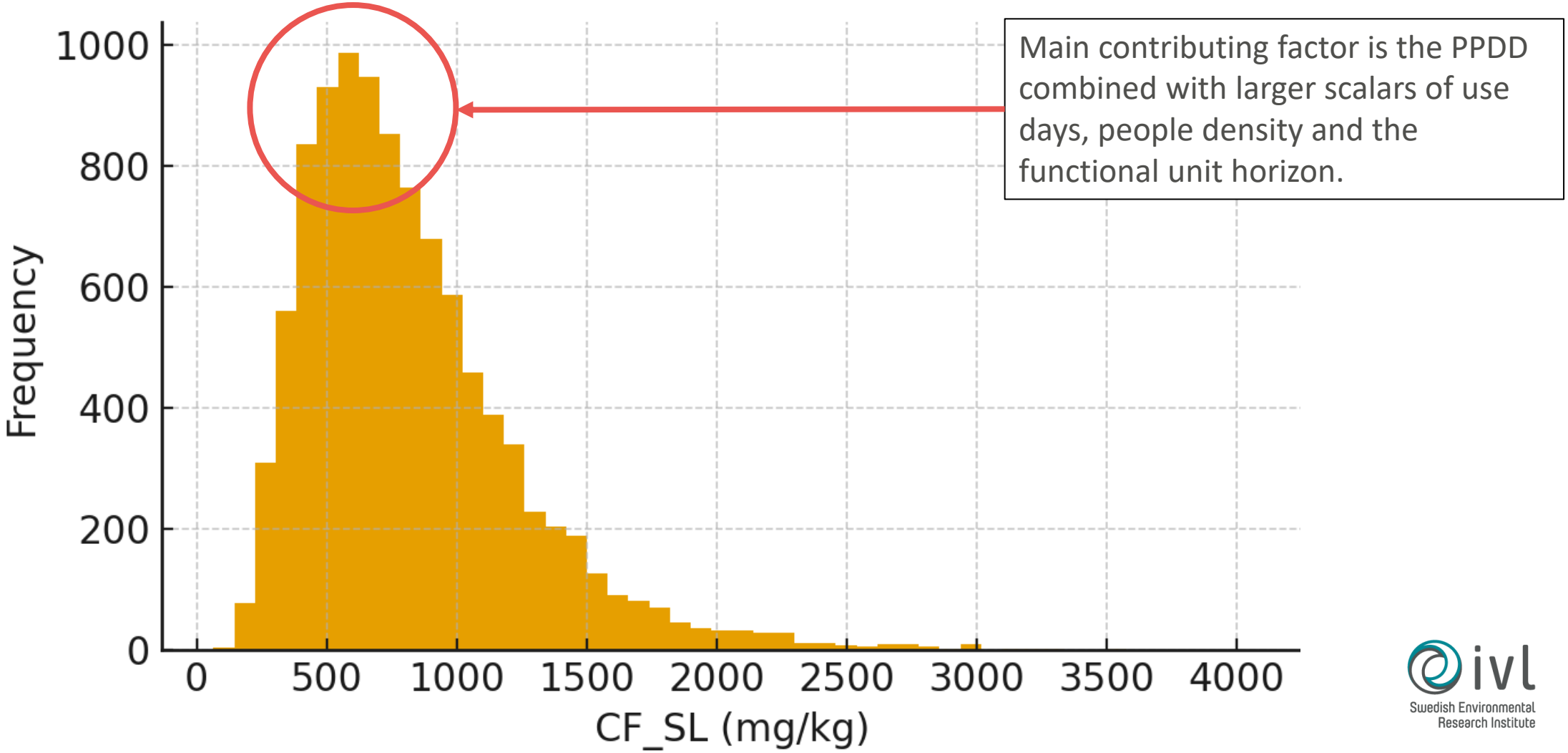

Main contributing factor is the PPDD combined with larger scalars of use days, people density and the functional unit horizon.

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Thank you for your attention!

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