Estimating Health-based Maximum Levels of PFAS in Drinking Water based on aggregated human exposure

PhD Carolina Vogs

94th EFSA Advisory Forum Meeting

4 – 5th December

PARC

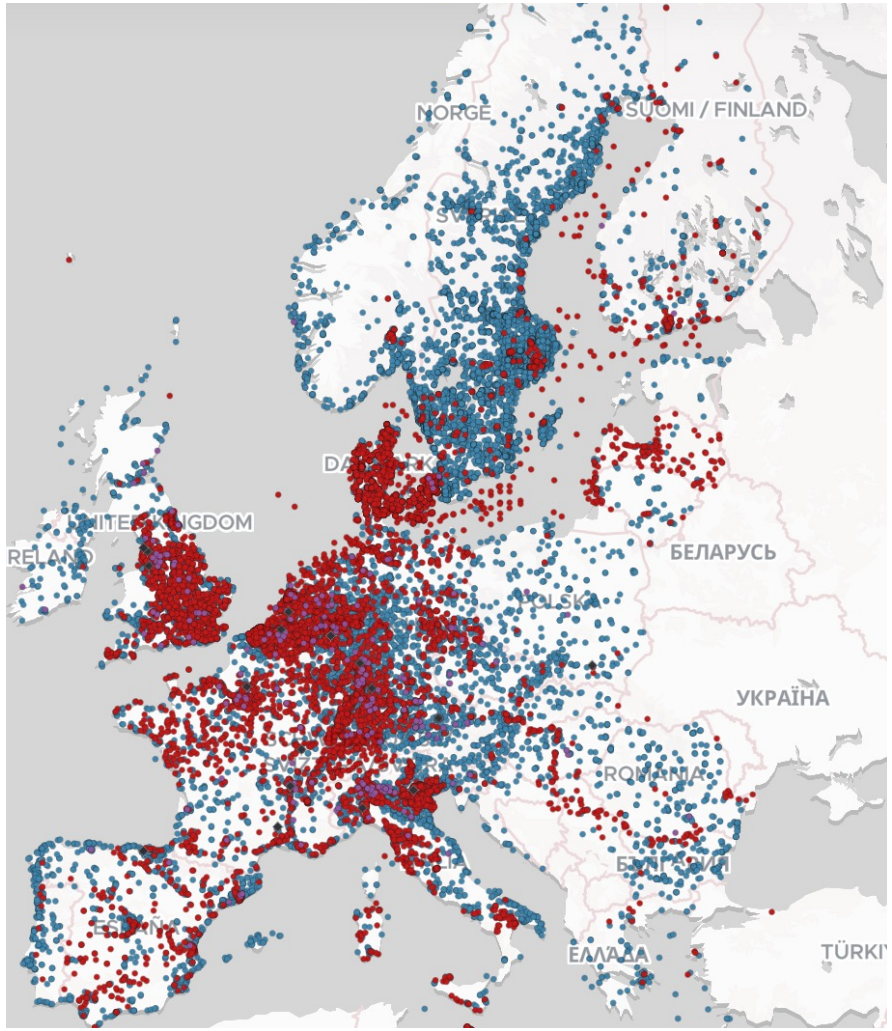
SLU

PFAS - Health & Environmental Concern in Sweden

https://www.aktuellhallbarhet.se/alla-nyheter/kommunrankning/har-gav-pfas-kartlaggning-battre-koll/

https://www.ronneby.se/sidowebbplatser/miljoteknik/nyheter/2023-12-19-pfas-domen---vad-hander-nu.html

PFAS – Global Health & Environmental Concern



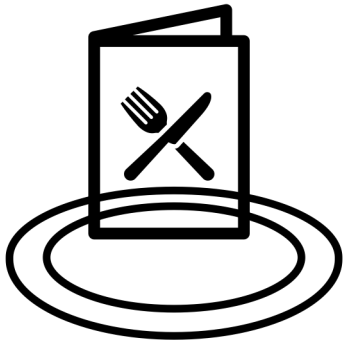
- PFAS are widely distributed in water sources
- PFAS are persistent in the environment
- > 10,000 PFAS-related structures

https://www.lemonde.fr/en/les-decodeurs/article/2023/02/23/forever-pollution-explore-the-map-of-europe-s-pfas-contamination_6016905_8.html

What level of PFAS in drinking water is associated with a higher probability of increased negative health concerns?

Aggregated Human Exposure

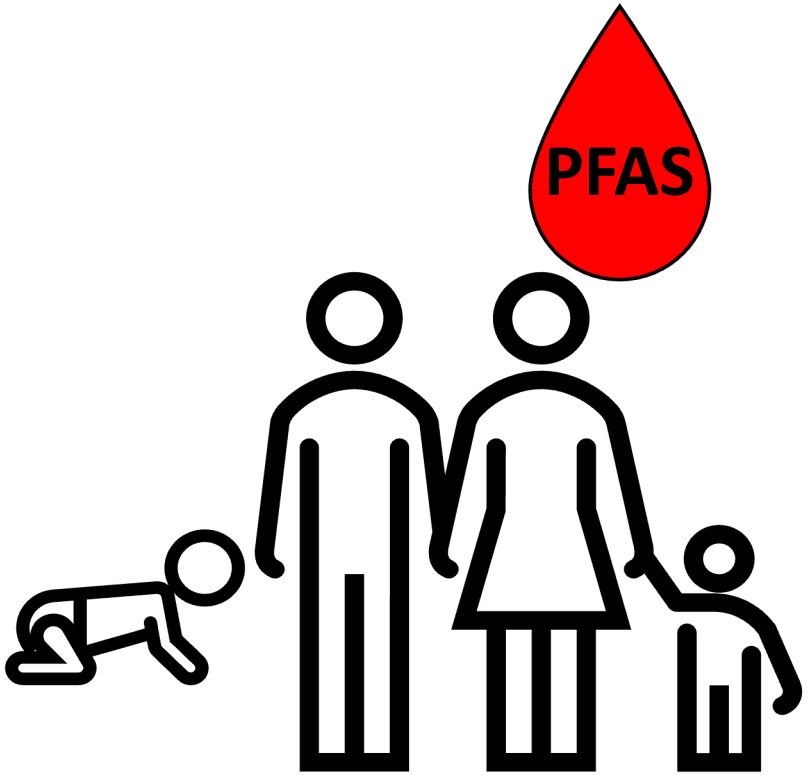
External Exposure



4.4 ng/kg bw per week

Tolerable Weekly Intake

Internal Exposure

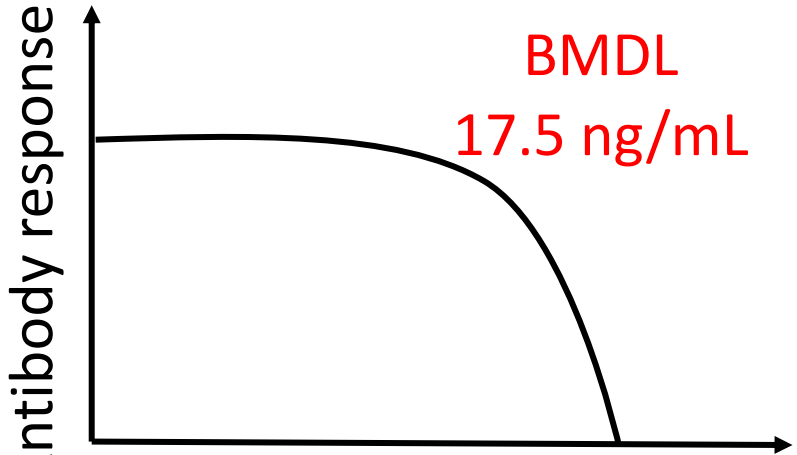


6.9 ng/mL

17.5 ng/mL

Health-based Guidance Value

Hazard

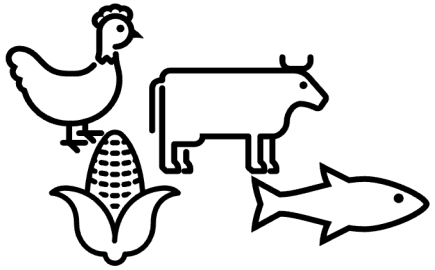


Critical Effect

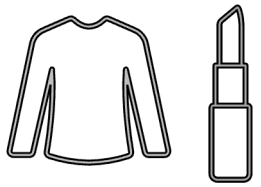
EFSA Panel on Contaminants in the Food Chain. 2020. Risk to human health related to the presence of perfluoroalkyl substances in food

Aggregated Human Exposure

External Exposure

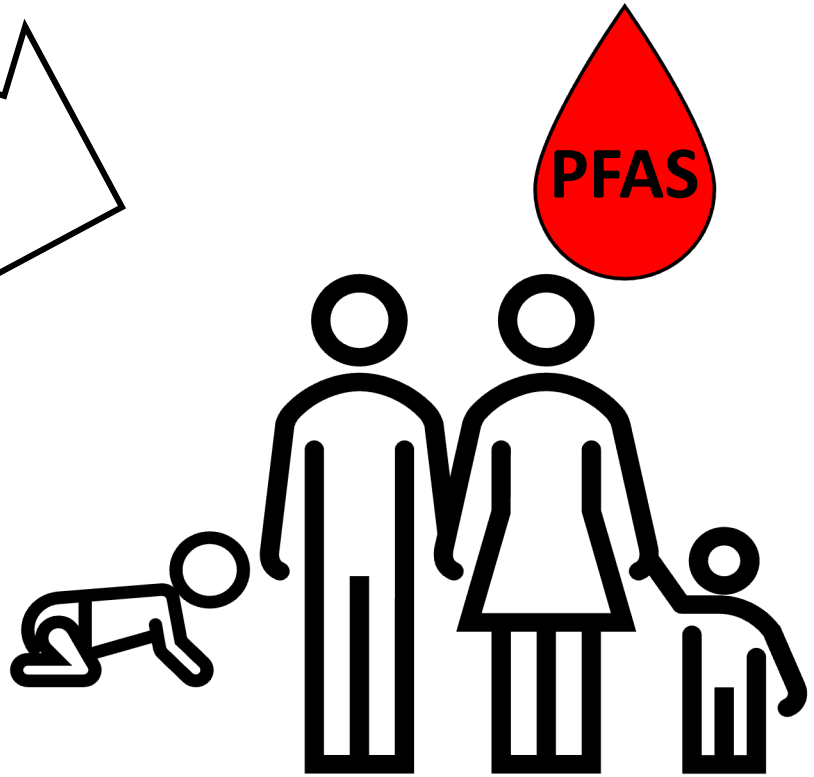


Food



Consumer Products

Internal Exposure



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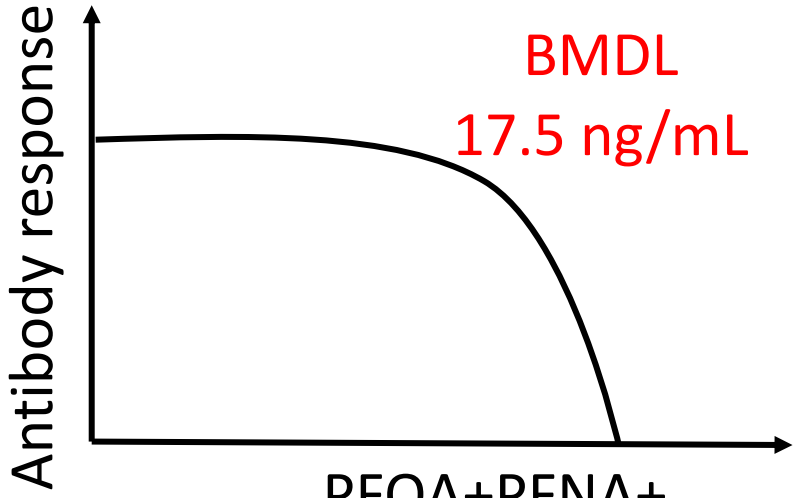
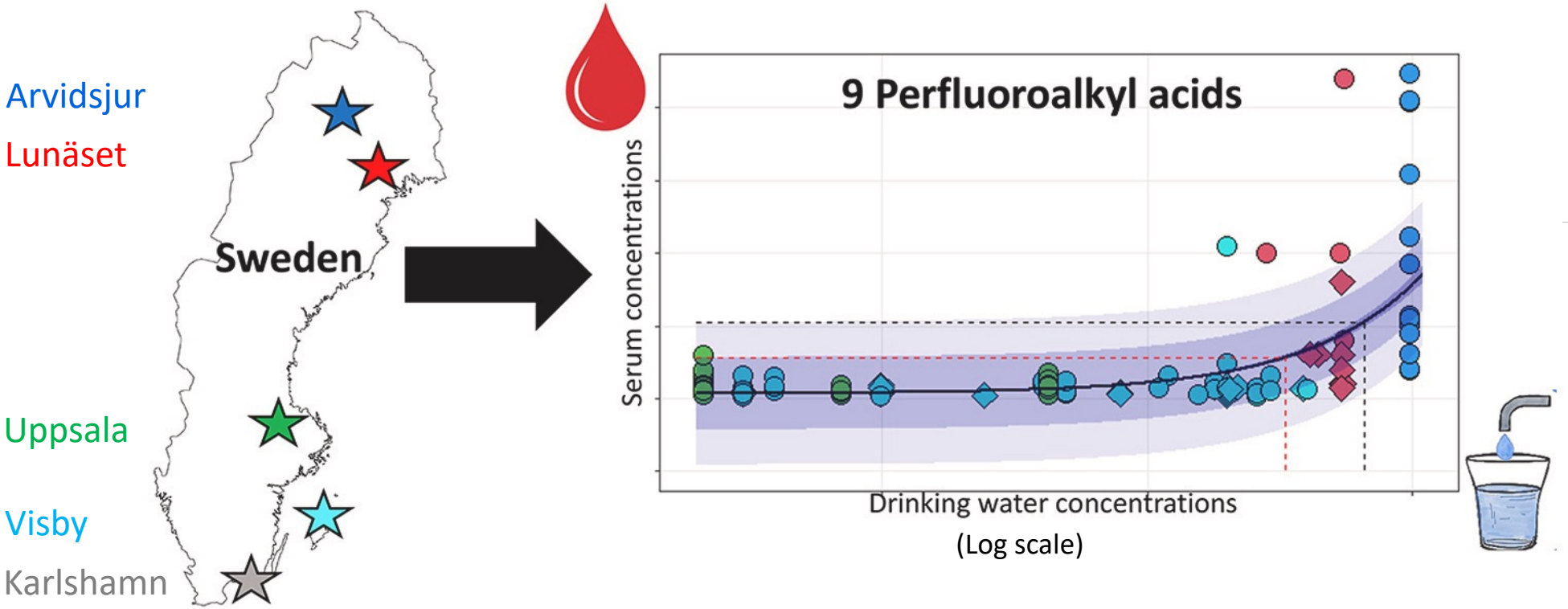


Critical Effect

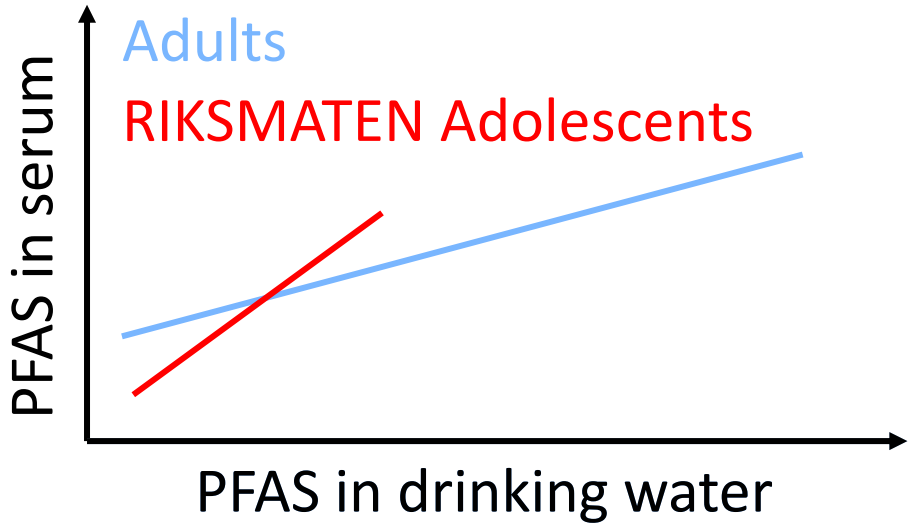
PFAS in Drinking Water as Exposure Source – Case Study I



- Serum concentration at background exposure from food consumption
- Serum:drinking water ratio
- Drinking water causes elevated serum concentrations above background

Adapted from: Johanson G, Gyllenhammar I, Ekstrand C, Pyko A, Xu Y, Li Y, Norström K, Lilja K, Lindh C, Benskin JP, Georgelis A, Forsell K, Jakobsson K, Glynn A, Vogs C. (2022) Quantitative relationships of perfluoroalkyl acids in drinking water associated with serum concentrations above background in adults living near contamination hotspots in Sweden. Environ Res. 16; 219:115024.

PFAS in Drinking Water as Exposure Source - Challenges



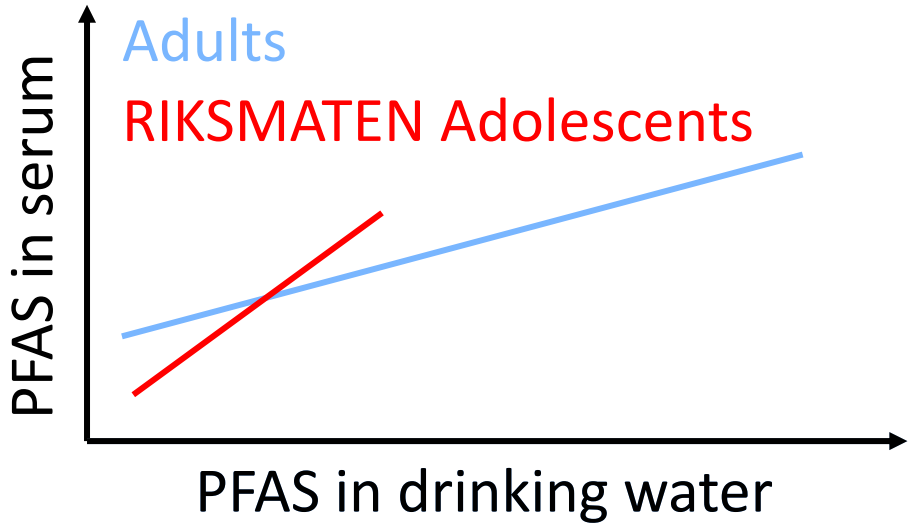
Epidemiological Conclusions

- Background exposure changes over time.
- High interindividual variation in PFAS levels
- Sex differences in aggregated exposure with the onset of menstruation
- Prenatal- and postnatal exposure
- Mixture risk assessment for many more PFAS than just the four PFAS

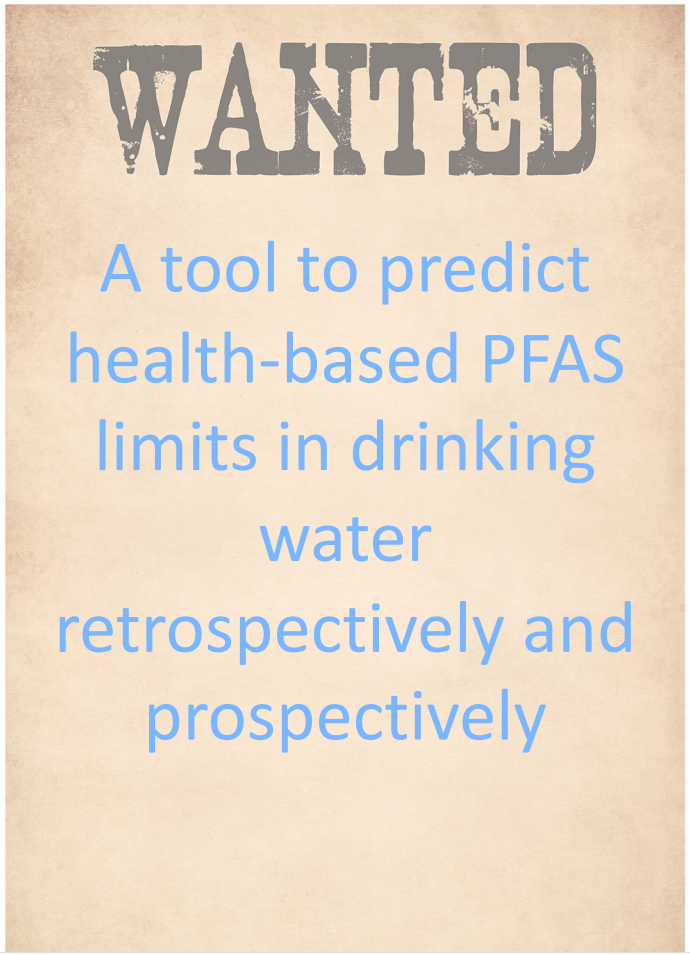
Adapted from: Johanson G, Gyllenhammar I, Ekstrand C, Pyko A, Xu Y, Li Y, Norström K, Lilja K, Lindh C, Benskin JP, Georgelis A, Forsell K, Jakobsson K, Glynn A, Vogs C. (2022) Quantitative relationships of perfluoroalkyl acids in drinking water associated with serum concentrations above background in adults living near contamination hotspots in Sweden. Environ Res. 16; 219:115024.

Adapted from: Nyström-Kandola J, Ahrens L, Glynn A, Johanson G, Benskin JB, Gyllenhammar I, Lignell S, Vogs C (2023). Low concentrations of perfluoroalkyl acids (PFAAs) in municipal drinking water associated with serum PFAA concentrations in Swedish adolescents. Environ. Int., 108166

PFAS in Drinking Water as Exposure Source - Challenges



Epidemiological Conclusions



Potential Application of Developed PARC Tools in Sweden

PARC WGs & Case Studies

PBPK model for 4 PFAS
(Lead by RIVM & WUR)

Lifetime physiology
(Lead by ANSES & SLU)

Uncertainty & Sensitivity
(Lead by RECETOX & IISPV)

Mixture Risk Assessment
(Lead by RIVM & ANSES)

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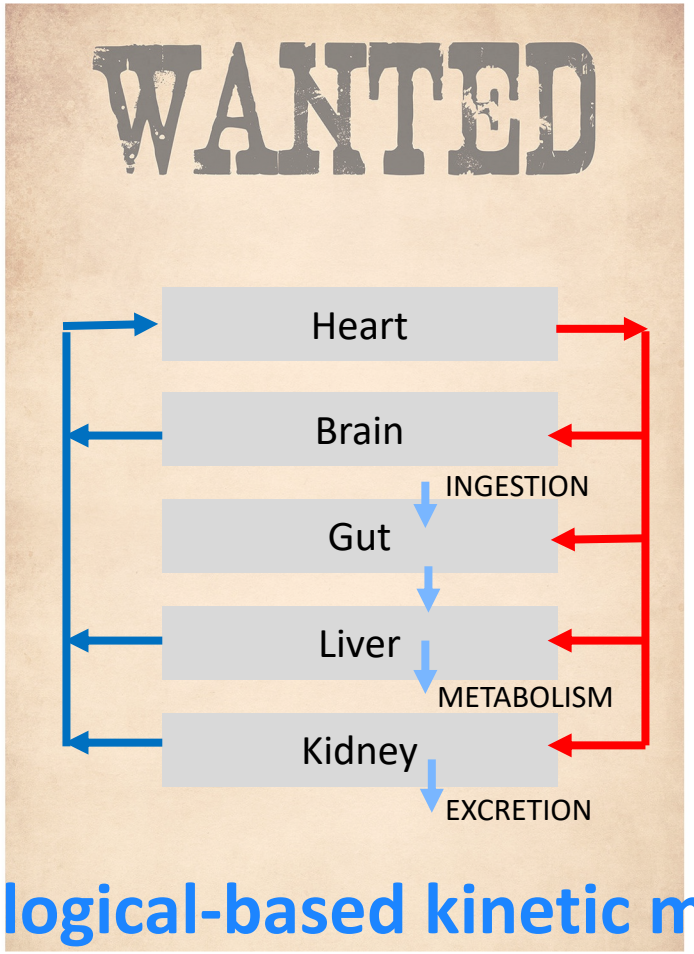
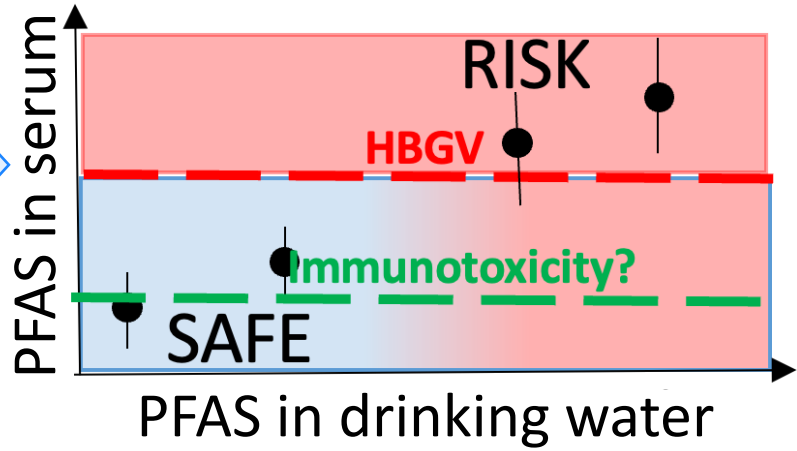


Physiological-based kinetic models

4PFAS &
PFAS not covered by TWI



PARC Experiences

Strengths	Weaknesses
➢ Motivated experts in modeling and risk assessment ➢ Novel tools are developed to tackle complex problems	➢ High administration demand ➢ Data quality and quantity may differ between surveys
Opportunities	**Threats**
➢ Harmonized HBM data protocols ➢ European-wide case studies	➢ May be too complex for the final application by national and international risk assessor agencies

Thank you for your attention!

Carolina.Vogs@slu.se

All Collaborators

SCIENCE AND EDUCATION FOR SUSTAINABLE LIFE