



Development of a protocol for the risk assessment of complex PFAS contaminations

2022-10-21, ENSOR-congres

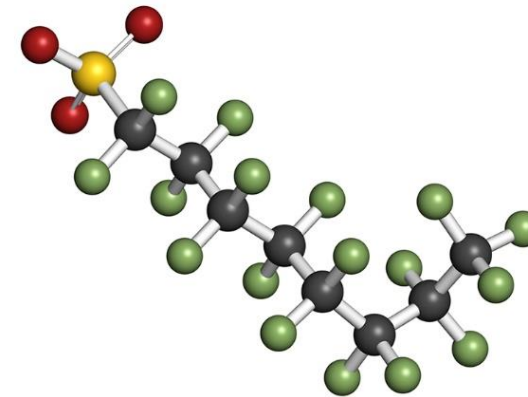
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Problem statement

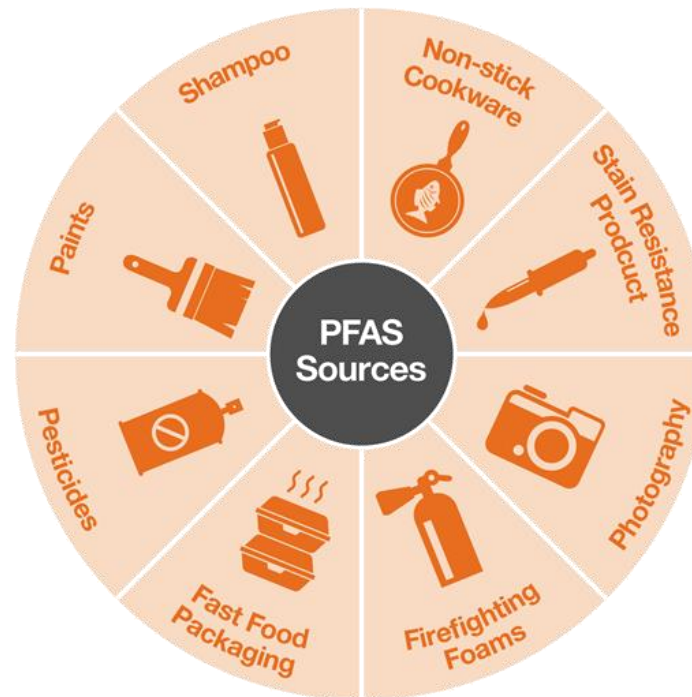
Identification → Assessment → Management
of PFAS contamination in ground and groundwater

- ▶ Inadequate **Identification**
 - ▶ Lack of adequate analysis protocols
 - ▶ False negative results
- ▶ Inadequate **Assessment**
 - ▶ No clear risk assessment protocols
 - ▶ Norms often arbitrary



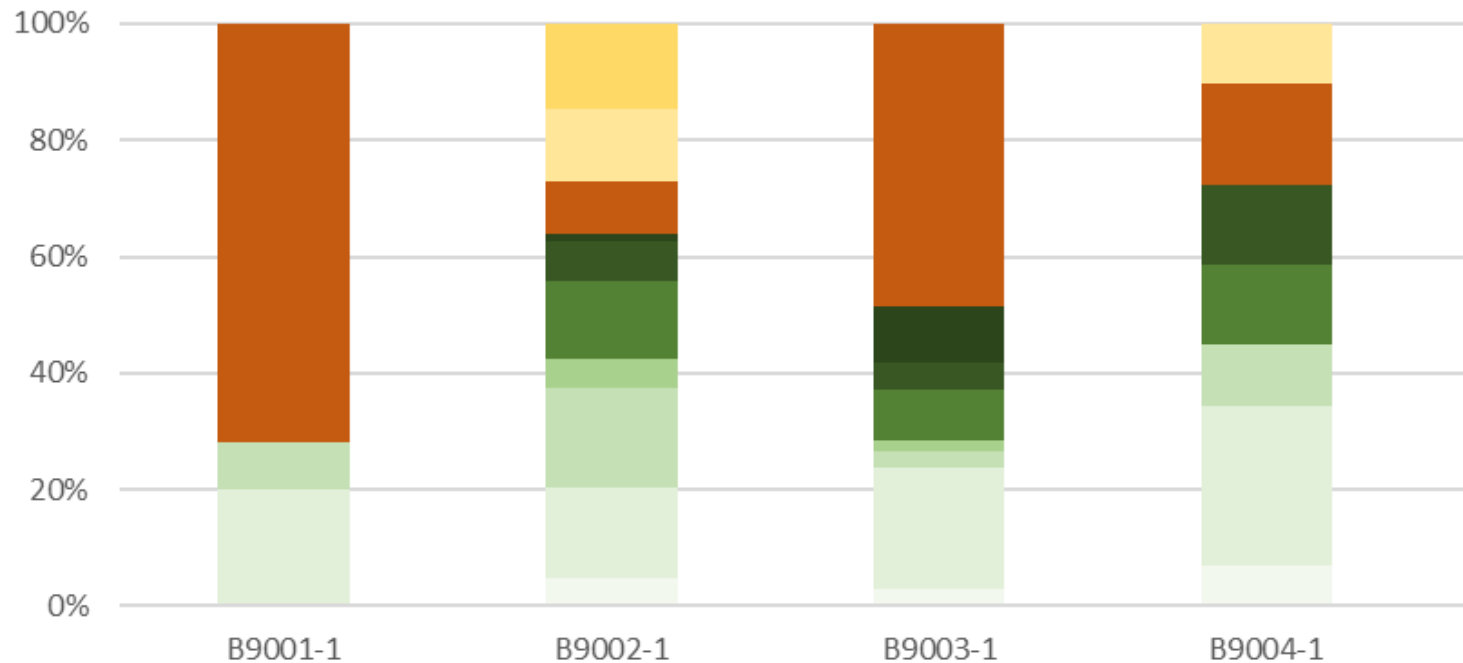
Objective

- ▶ Development of **quantification protocol** for total PFAS contamination
- ▶ Development of **risk evaluation protocol**
 - ▶ single components
 - ▶ mixtures



Case: foam intervention - soil

Relatieve concentraties grond



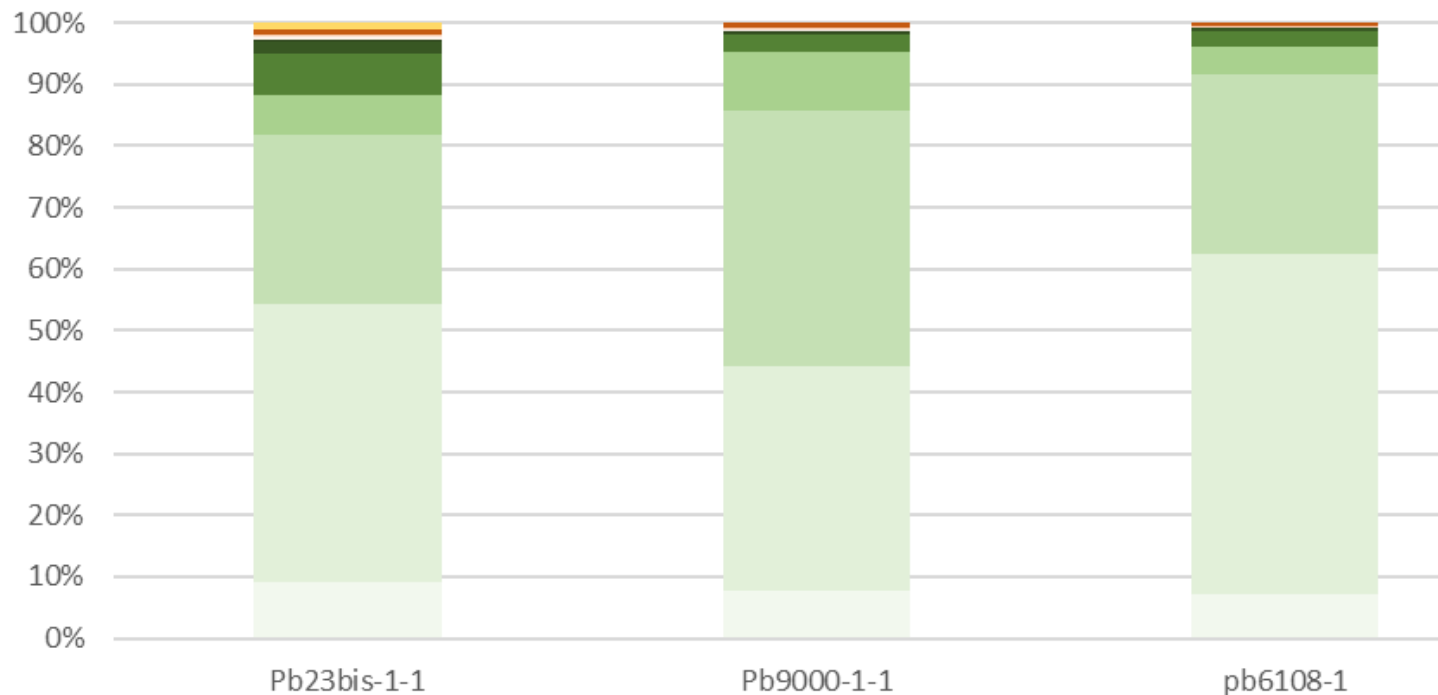
	short → long chain				
PFCA	Light Green	Light Green	Light Green	Dark Green	Dark Green
PFSA	Light Orange	Light Orange	Light Orange	Dark Orange	Dark Orange
FTS	Yellow	Yellow	Yellow		

- PFBA
- PFPeA
- PFHxA
- PFHpA
- PFOA
- PFNA
- PFDA
- PFUnDA
- PFDoA
- PFTrDA
- PFTeDA
- PFHxDA
- PFBS
- PFPeS
- PFHxS
- PFHpS
- PFOS
- PFNS
- PFDS
- 4:2 FTS
- 6:2 FTS
- 8:2 FTS
- PFOSA
- MePFOSA
- EtPFOSA
- MePFOSAA
- EtPFOSAA
- 8:2 diPAP
- HFPO-DA
- ADONA
- PFECHS



Case: foam intervention - groundwater

Relatieve concentraties grondwater



	short → long chain				
PFCA	Light Green	Light Green	Light Green	Dark Green	Dark Green
PFSA	Light Orange	Light Orange	Light Orange	Dark Orange	Dark Orange
FTS	Light Yellow	Light Yellow	Light Yellow		

- PFBA
- PFPeA
- PFHxA
- PFHpA
- PFOA
- PFNA
- PFDeA
- PFUnDA
- PFDoDA
- PFTeDA
- PFHxDA
- PFBS
- PFPeS
- PFHxS
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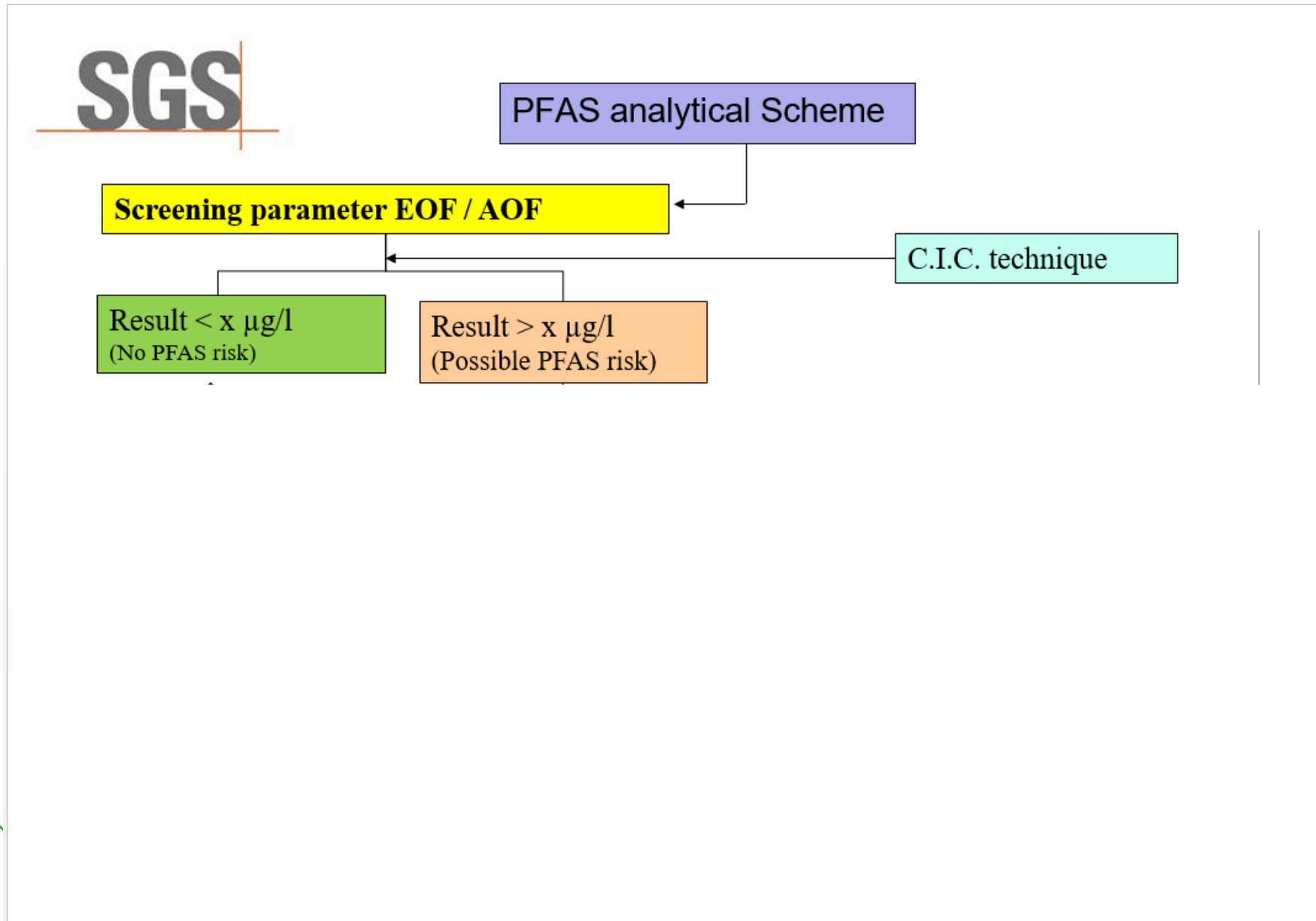


Methods

▶ Improved quantification via **3 step method**



3 step method



Methods

- ▶ Improved quantification via **3 step method**
- ▶ Improved **risk assessment**:
 - ▶ Ecotoxicity tests
 - ▶ Single PFAS components
 - ▶ Mixtures
 - ▶ Bioassay tool



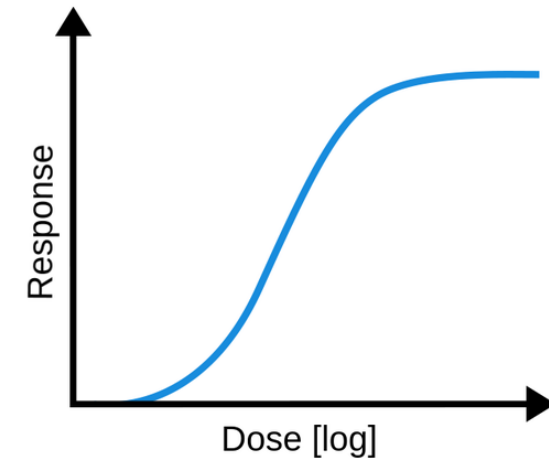
Risk evaluation

- ▶ **Ecotox impact** observable on microorganisms?
- ▶ Can **lowest effect level** be determined?
- ▶ **Influence of mixture** on the ecotox behaviour?



Risk evaluation - Ecotoxicity

- ▶ **Organism** selection according to trophic levels
 - ▶ Algae (*pseudokirchneriella*), *Daphnia magna*, Fish (*Danio rerio*)
- ▶ **Single PFAS** effect assessment
 - ▶ Concentration response curve
 - ▶ Input for models
- ▶ Artificial **PFAS mixture** effect assessment
- ▶ Experimental assessment of all mixtures **too costly**



Risk evaluation – bioassay tool

- ▶ Bioassay tool development enables **site specific risk assessment**
 - ▶ pilot sites
 - ▶ replication sites
 - ▶ and future commercial use
- ▶ Benefits **efficiency** and **price**



Prospects of PFAS assessment

- ▶ **3-step method** for total PFAS estimation avoids false negative results
- ▶ **Bioassay tool** for risk assessment enables site specific decisionmaking on PFAS-contaminated sites
- ▶ Driver for EU policies & legislation on PFAS



Take home

- ▶ Avoid underestimation of PFAS contamination
 - ▶ Who bears the liability?
- ▶ Improved contamination assessment through better quantification and risk evaluation





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