



Using chromatographic effects of different PFAS in effective site characterisation and remediation

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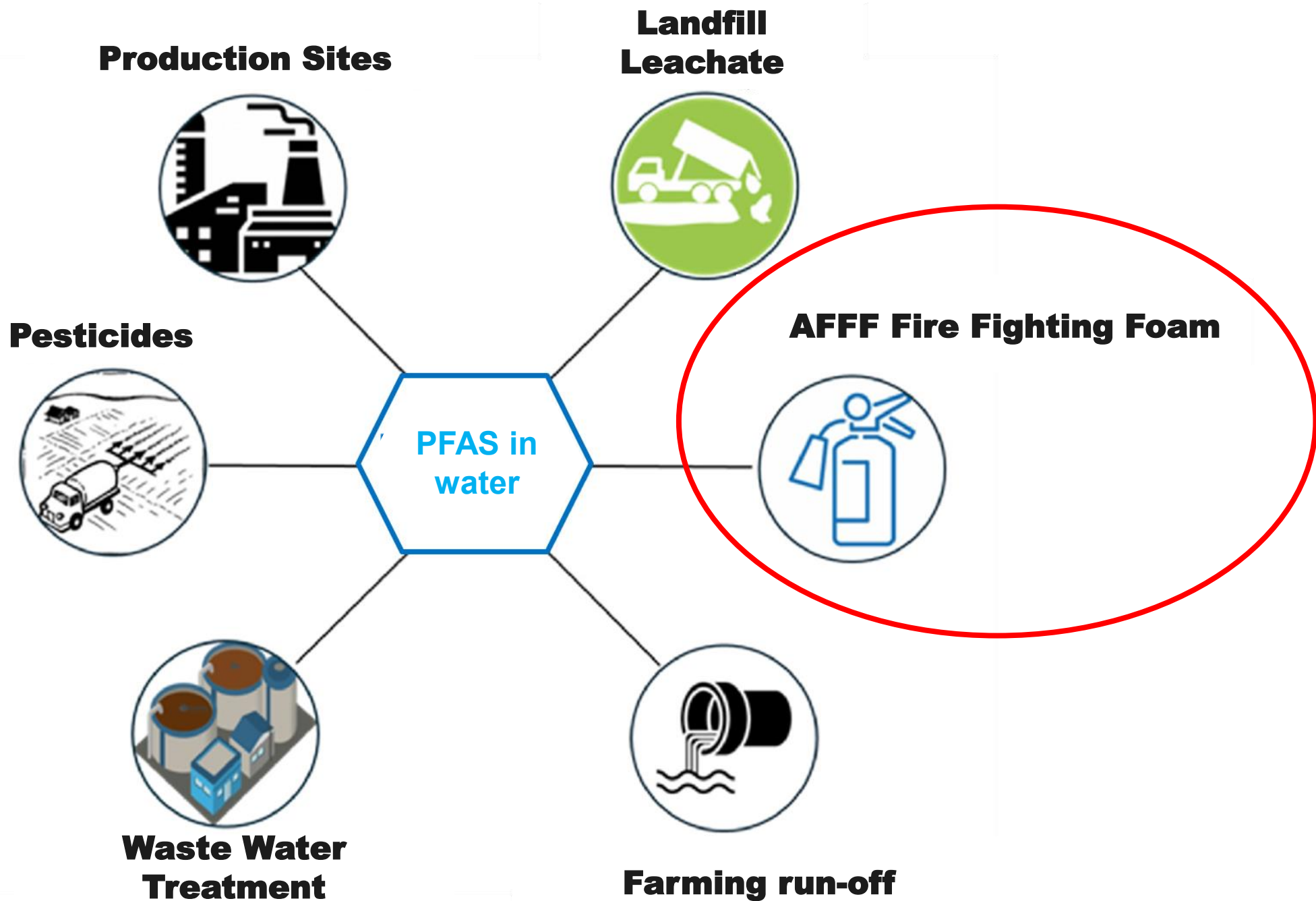
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Sustainability is our business

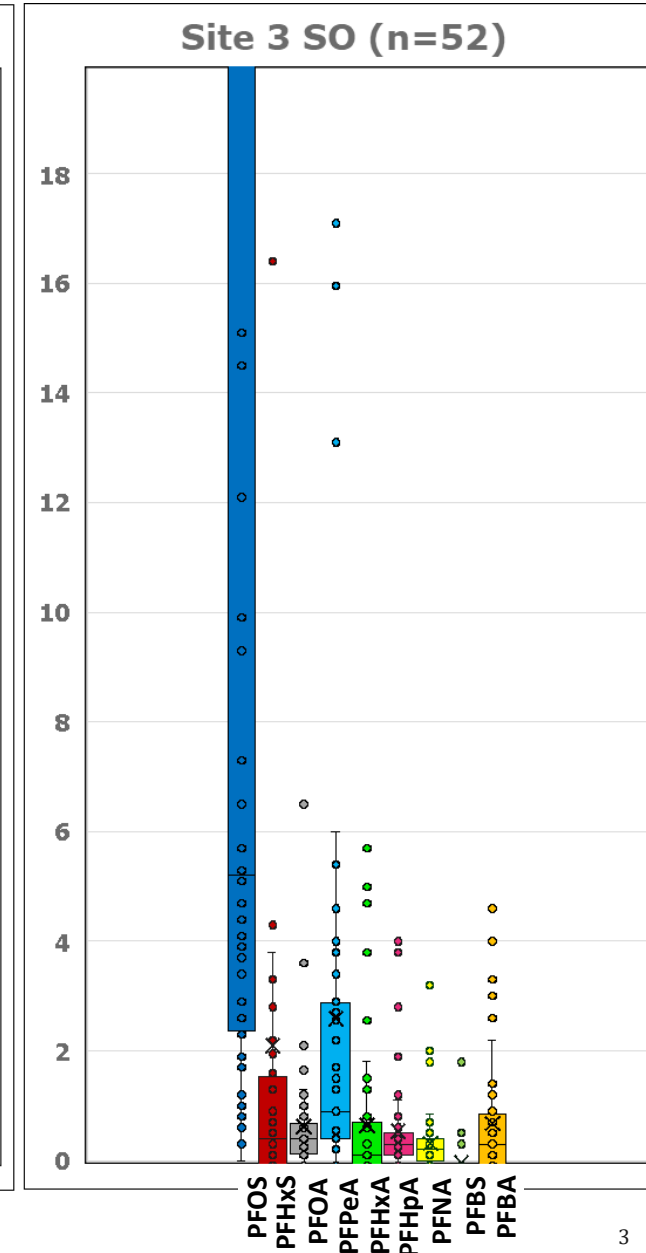
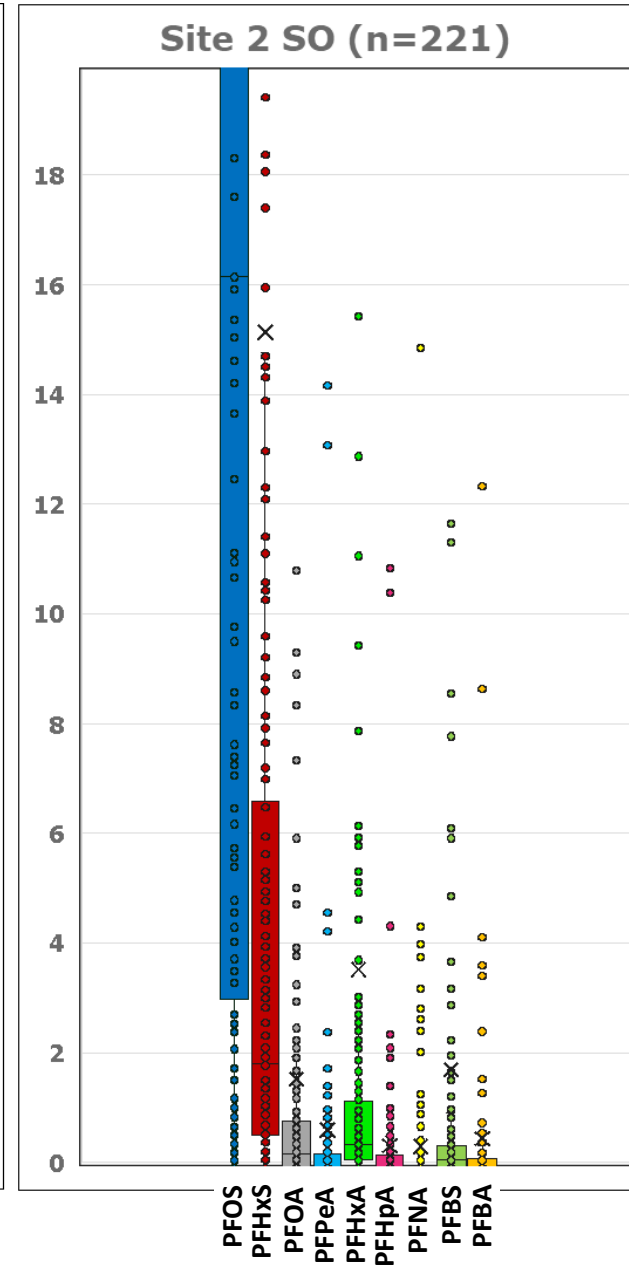
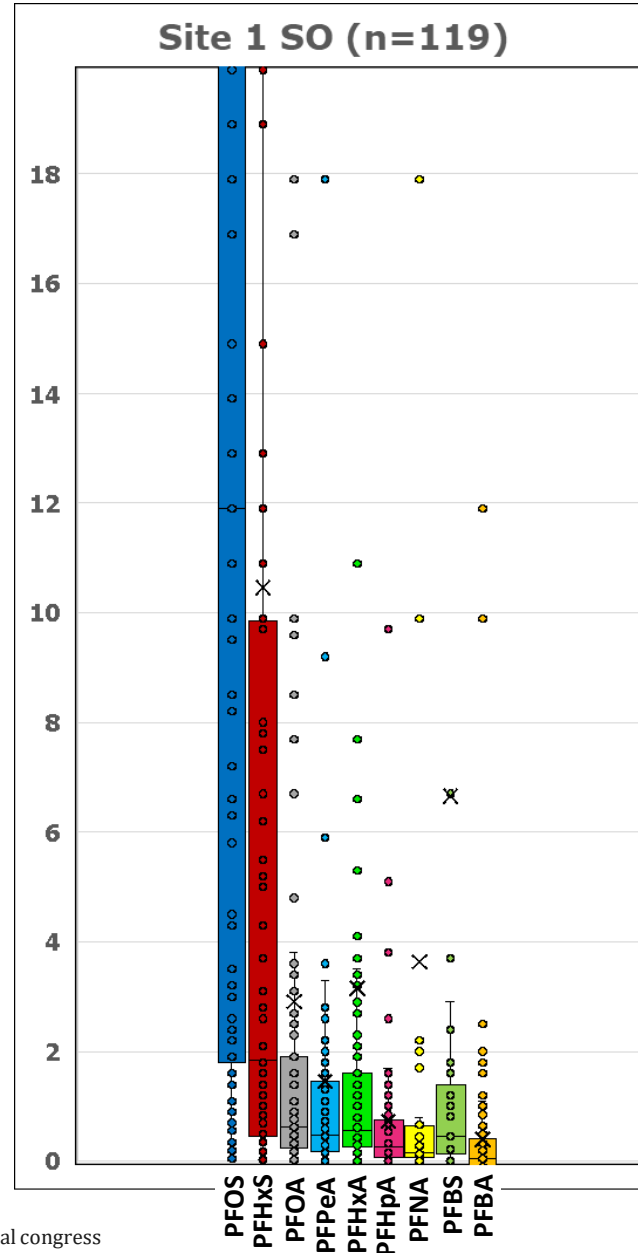
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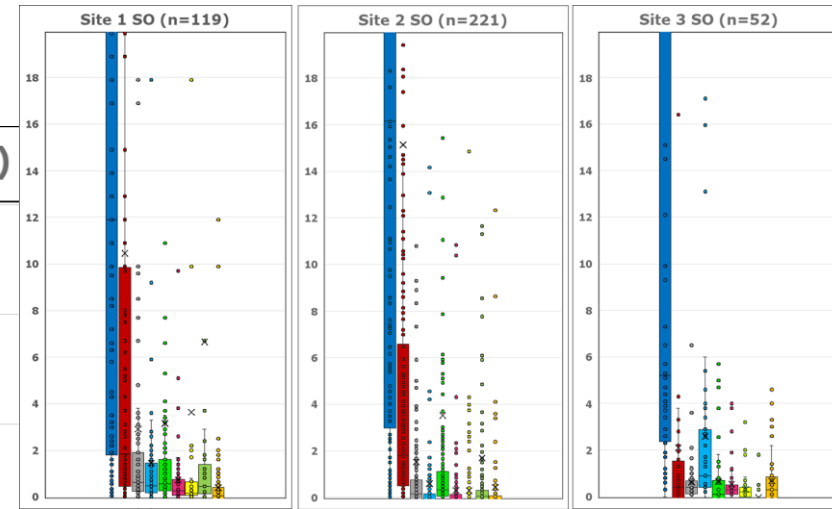
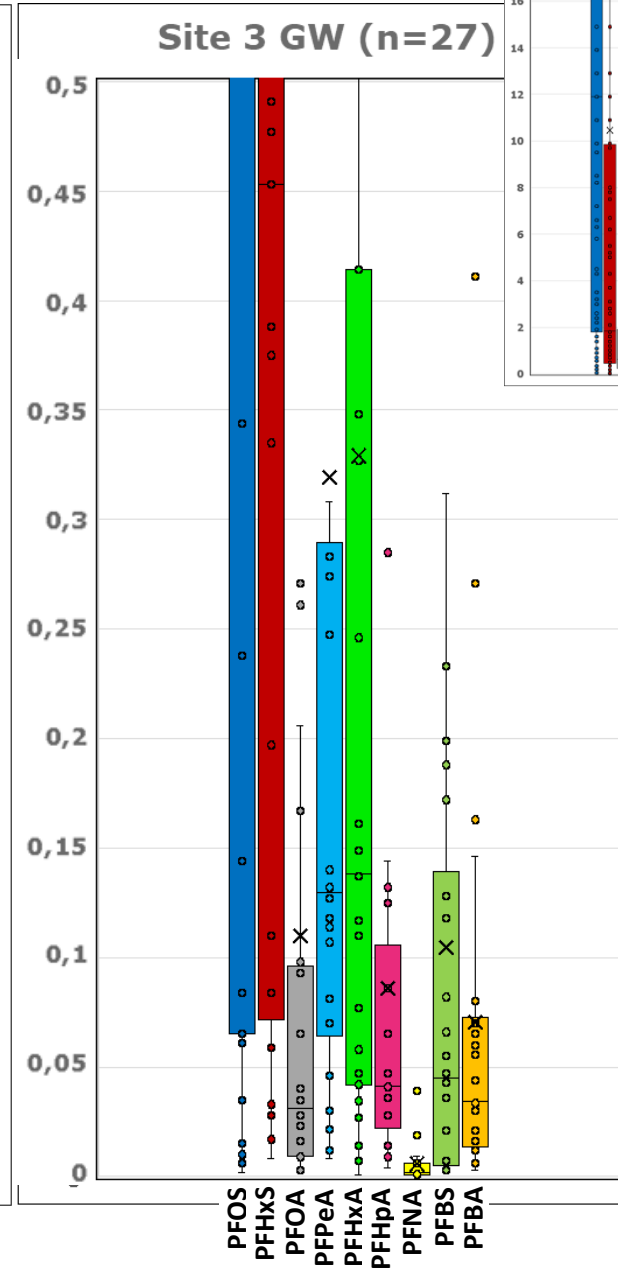
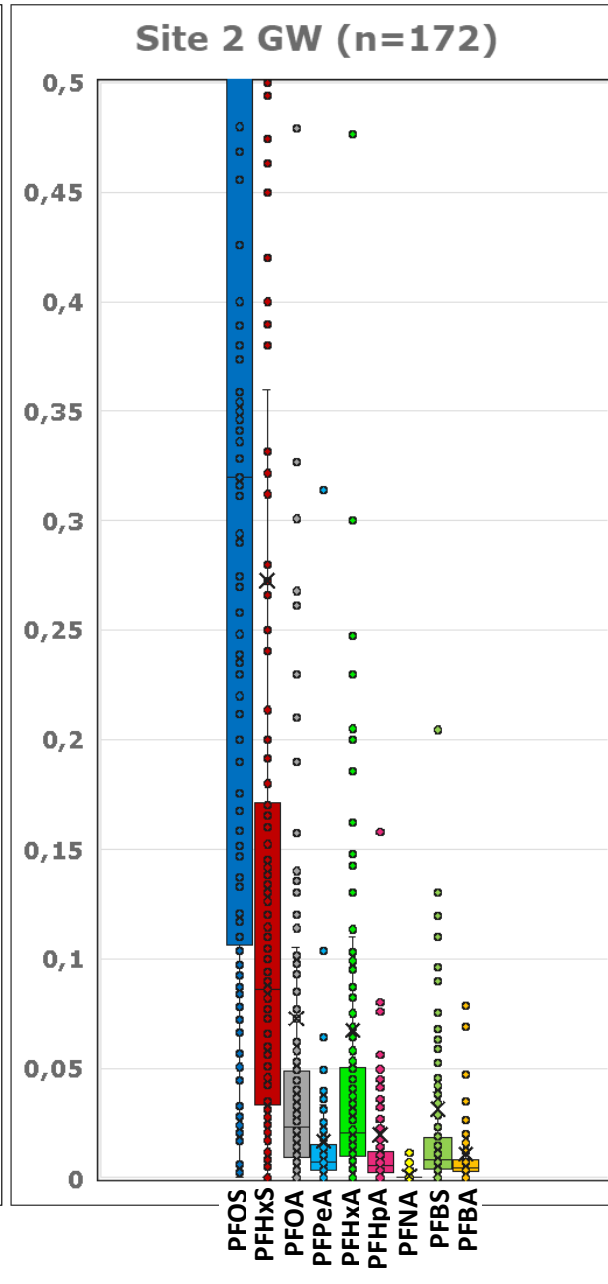
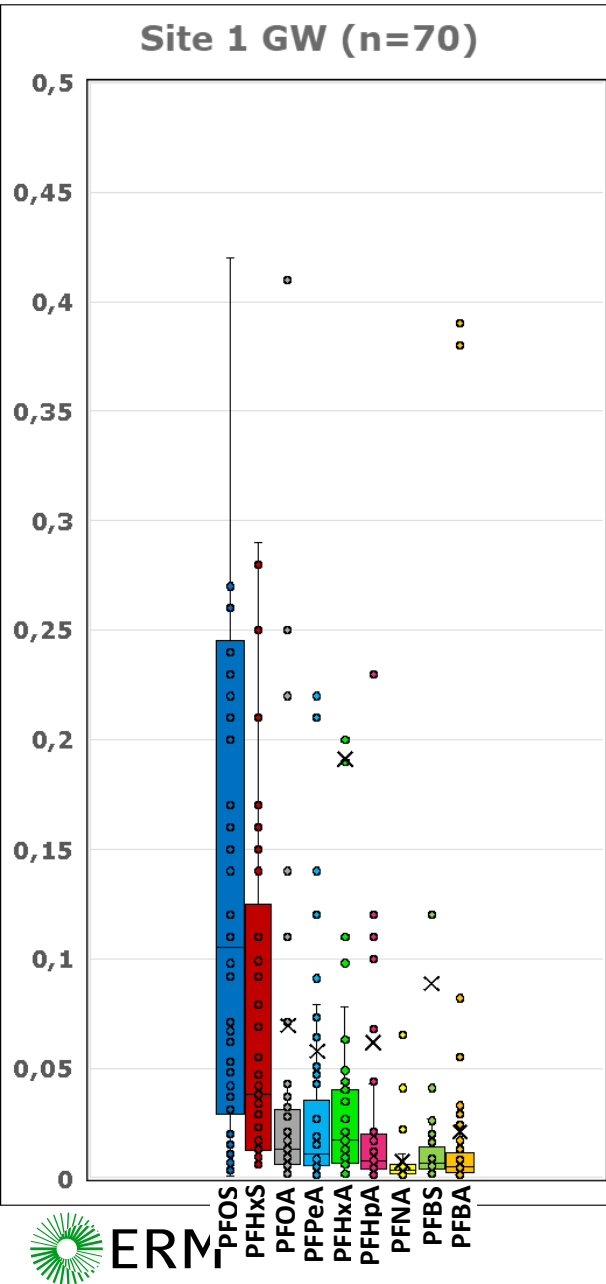


PFAS Distribution in Soil

- 3 sites in Switzerland.
- Each Box Plot represents the full range of PFAS detections in ug/kg.
- Source: AFFF foam.
- PFOS prevailing.
- PFHxS at 2 sites, PFPeA at the 3rd site (3).
- Typical AFFF product blend (*Backe et al., 2013*).
 - PFOS 80%
 - PFHxS ~9%



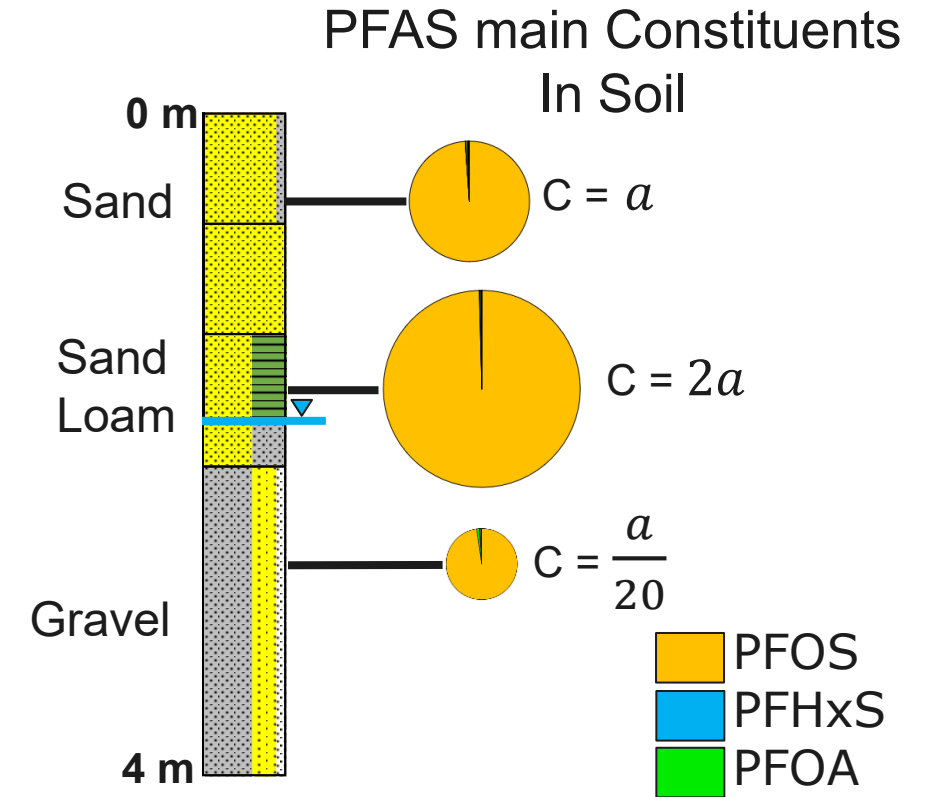
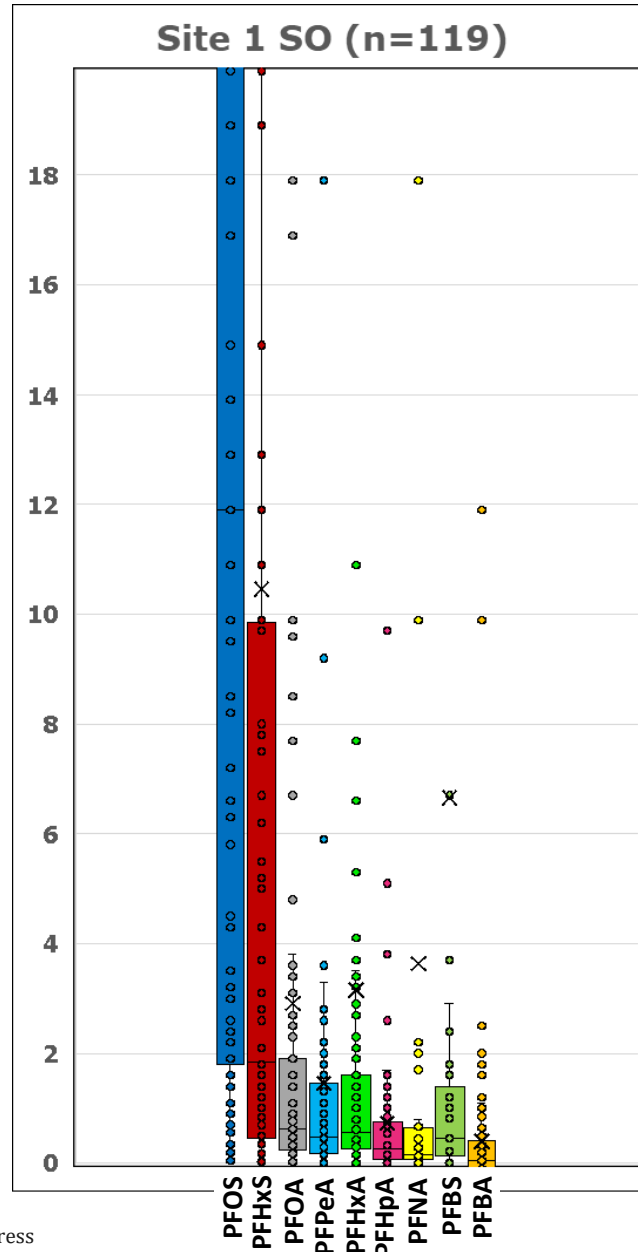
PFAS in Groundwater



- PFOS prevailing.
- PFHxS 2nd highest at all 3 sites.
- Marked differences at 3rd site.

Site 1 - PFAS Distribution in Soil

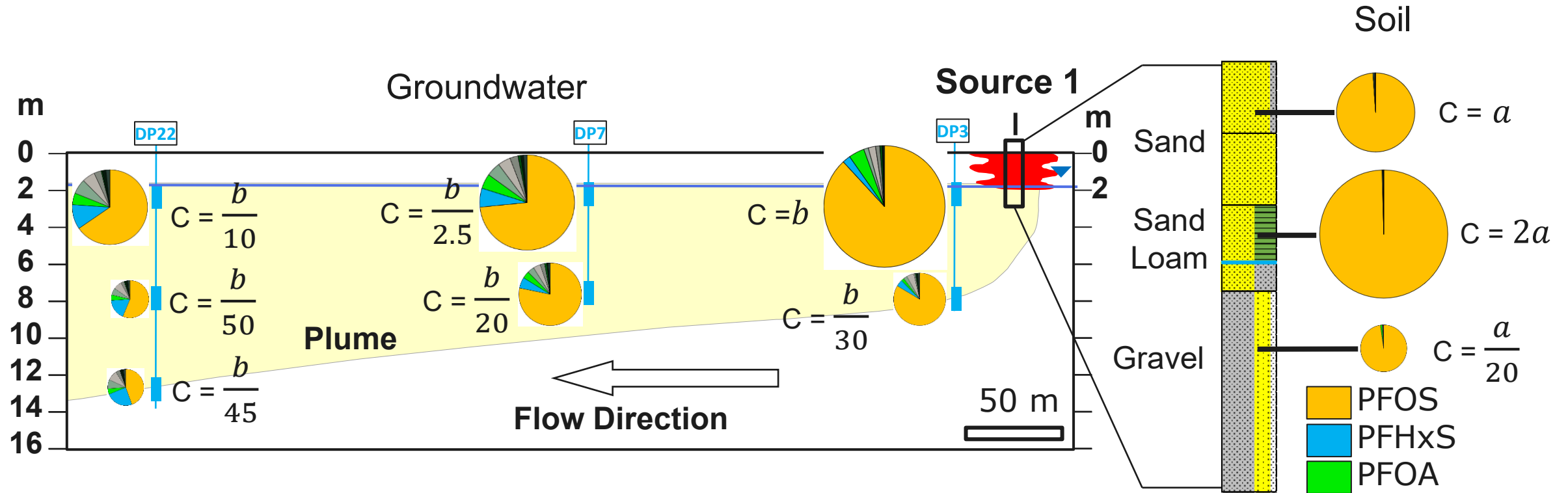
- 119 samples spread over a depth range from 0 – 5m



PFAS Source Area

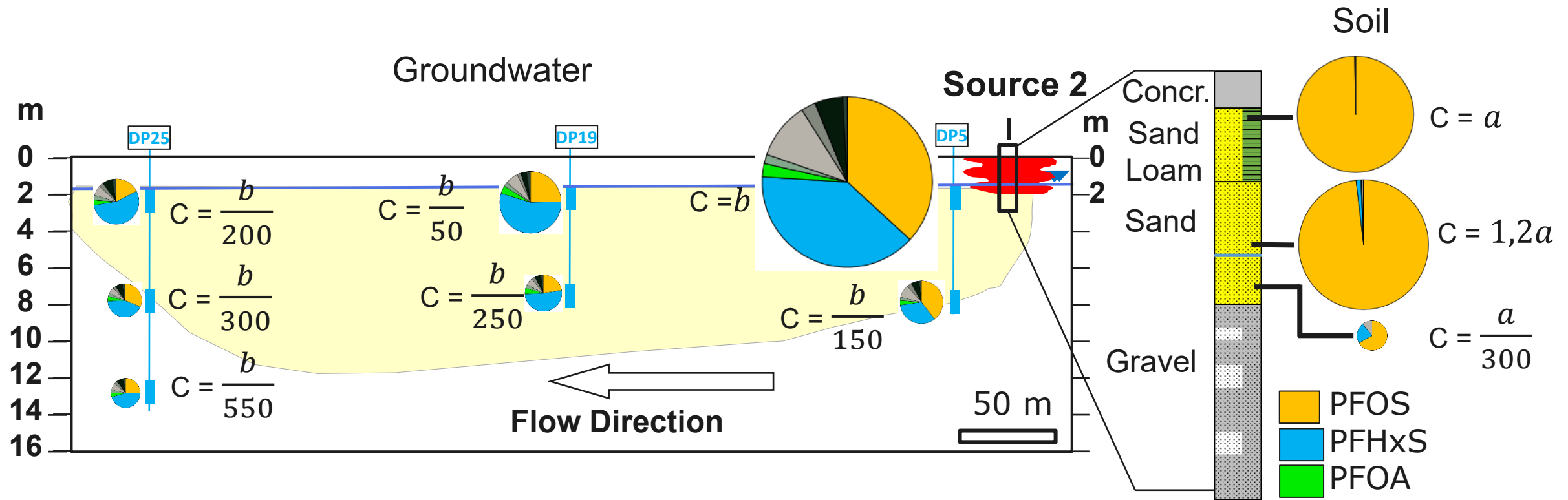
- PFOS prevailing constituent (97-99%)
- Other PFAS (1-3%) lead by PFHxS
- $\Sigma 9$ PFAS: up to 10'000 $\mu\text{g}/\text{kg}$

Site 1 – PFAS Distribution in the Source Area 1



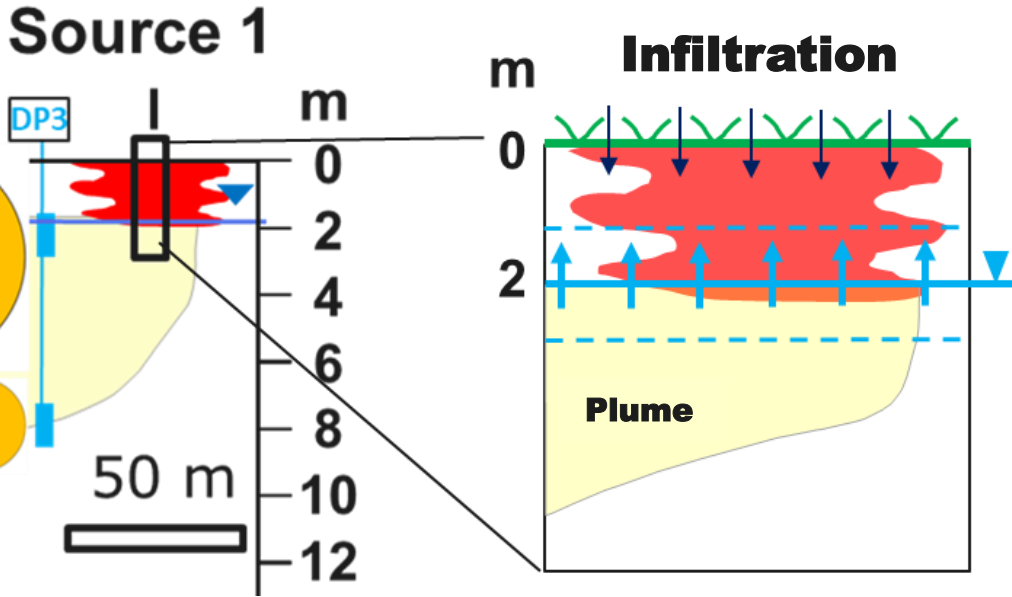
- PFOS is the dominant compound in groundwater.
- Change of relative concentrations / PFAS mixture .
- PFOS decreases in relative concentration against other PFAS, mostly PFHxS, with depth and travel distance.

Site 1 –PFAS Distribution in Source Area 2



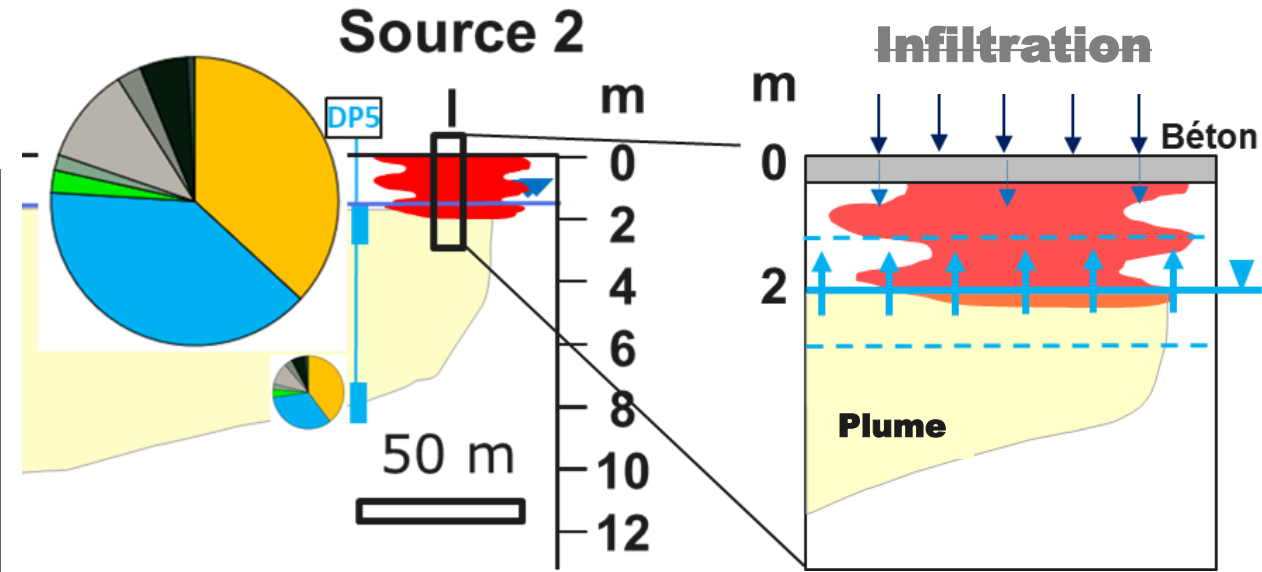
- PFOS prevailing, followed by PFHxS.
- PFAS distribution changes along travel path in groundwater.
- Much wider range of PFAS composition in groundwater than in soil.
- PFHxS is the dominant compound in the plume.

Site 1 – Comparison of Source Areas 1 et 2



Source Area 1

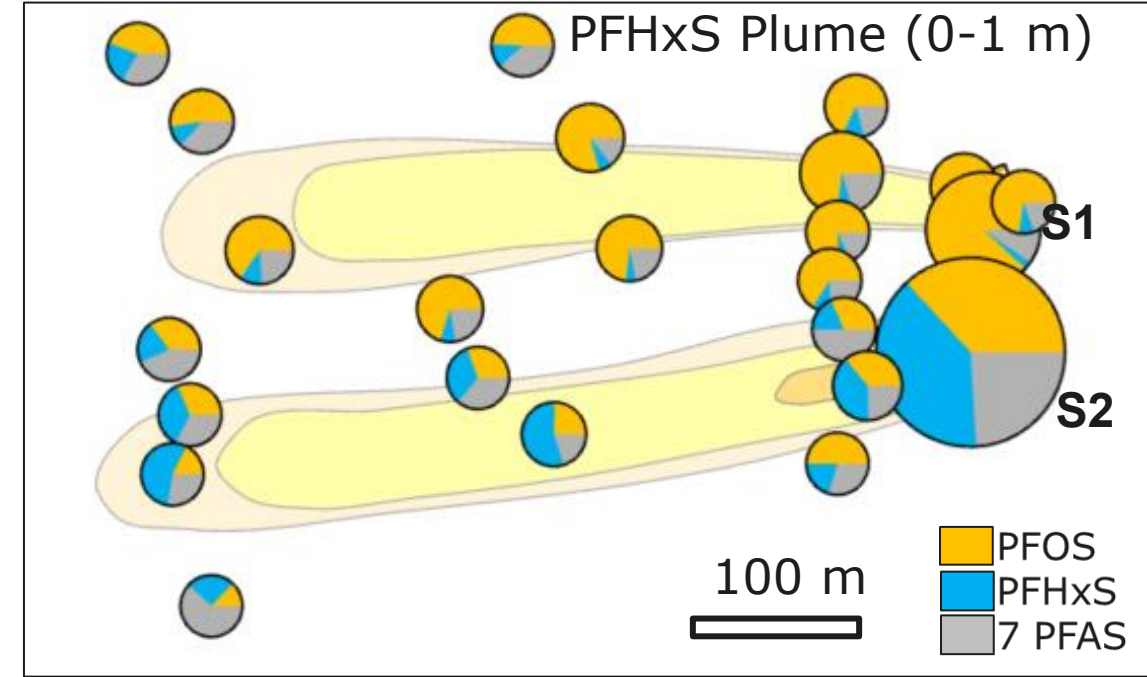
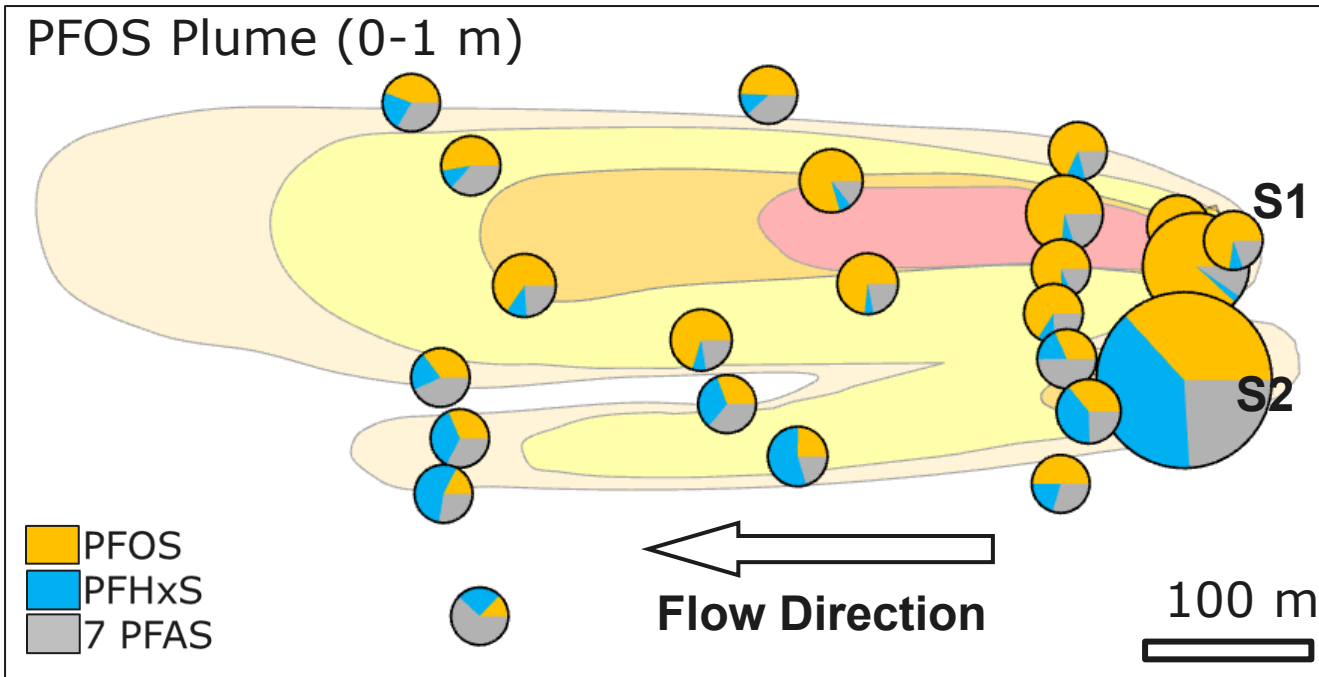
- No surface cover.
- Direct infiltration and groundwater table fluctuation → leaching of PFAS.
- Dilution → relatively lower concentrations directly downgradient of the source area.



Source Area 2

- Hard standing \rightarrow no infiltration
- Fluctuation de la nappe dans la source
- Dilution is lower than in source are 1 \rightarrow higher concentrations directly downgradient.

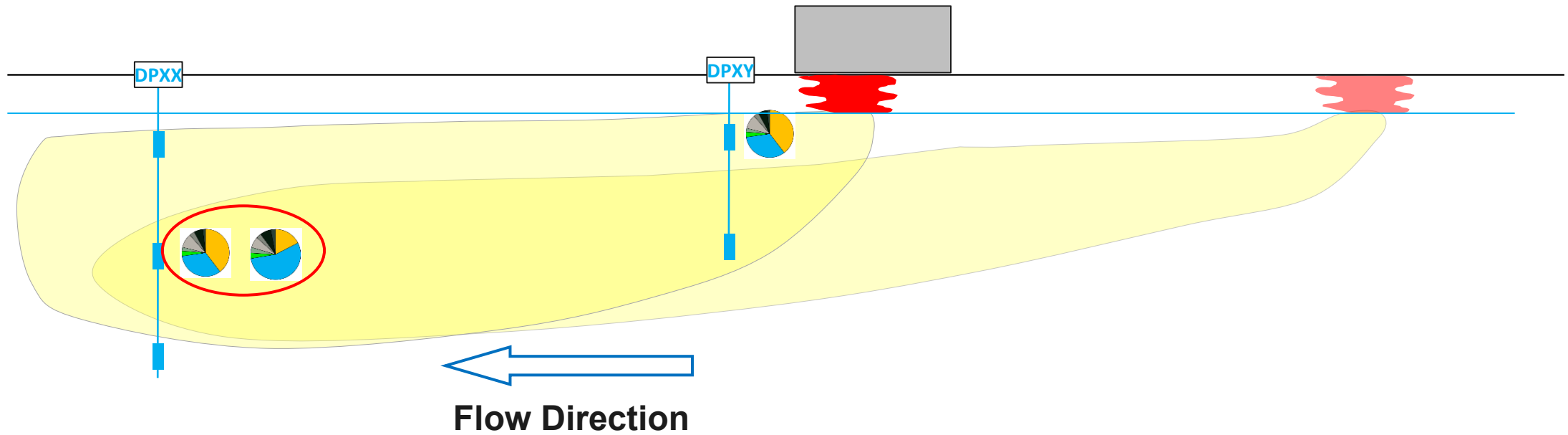
Overview



- Same AFFF used.
- Very similar subsurface conditions.
- PFAS Compositions very similar in Source Areas 1 & 2, but markedly different with travel path in groundwater.

Site Investigation Application

Inferring unknown source areas from the fingerprint of PFAS in a plume



Conclusions

- The value of a sound Site Conceptual Model
- PFAS compound-specific transport behaviour can be used effectively in site characterisation and remedial design
- An «inductive» site investigation approach versus the classical «deductive» process may help track «hidden» source areas
- Data-driven decision making

Thank you

