

Working on PFAS Impacted Sites

Yorkshire Contaminated Land forum

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Who am I?

- Dr Richard Williams
- Technical Specialist at VertaseFLI
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This Presentation:

1. PFAS as a Contaminant
2. Sampling for PFAS
3. PFAS in Groundwater
4. PFAS in Soil
5. PFAS impacted concrete



01 PFAS as a contaminant



What are PFAS?

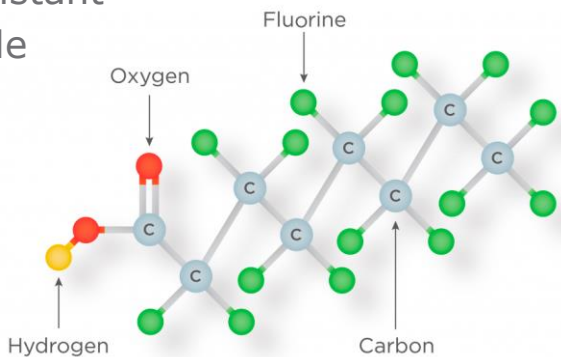
PFAS: **P**er and **p**oly**f**luoro**a**lky**l** **S**ubstances

Synthetic organoflurine chemical compound

At least 9000 different PFAS compounds

Main benefits of PFAS are:

- Heat resistant
- Oil resistant
- Water resistant
- Very stable



A PFOA Molecule



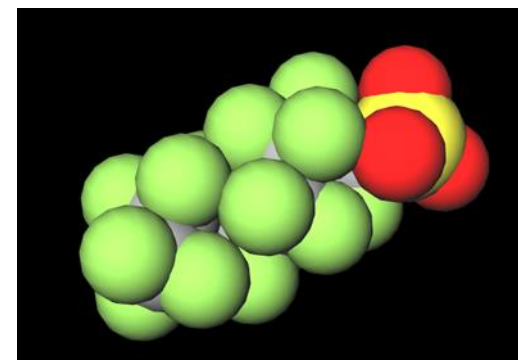
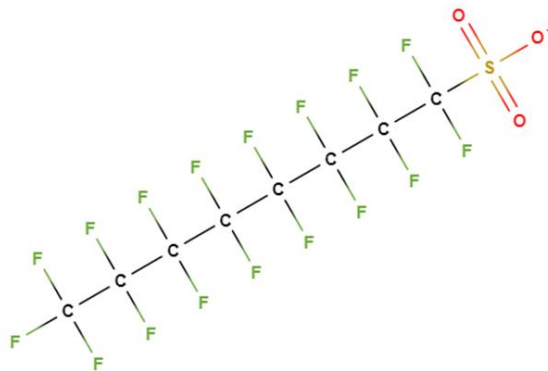
Why are they a problem?



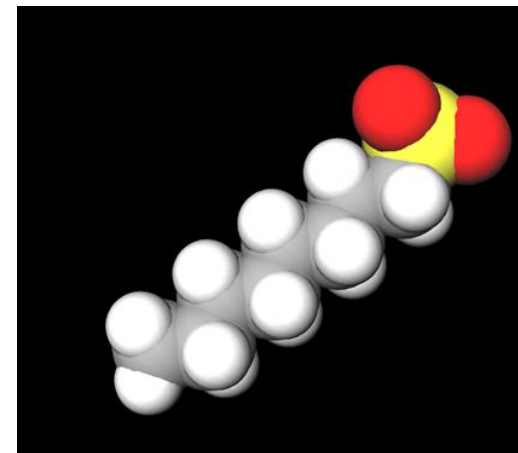
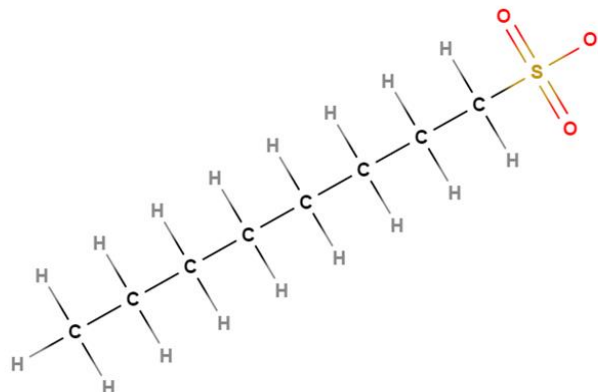
PERSISTANT

'Forever chemicals'

Perfluorooctane Sulfonate $C_8F_{17}SO_3$



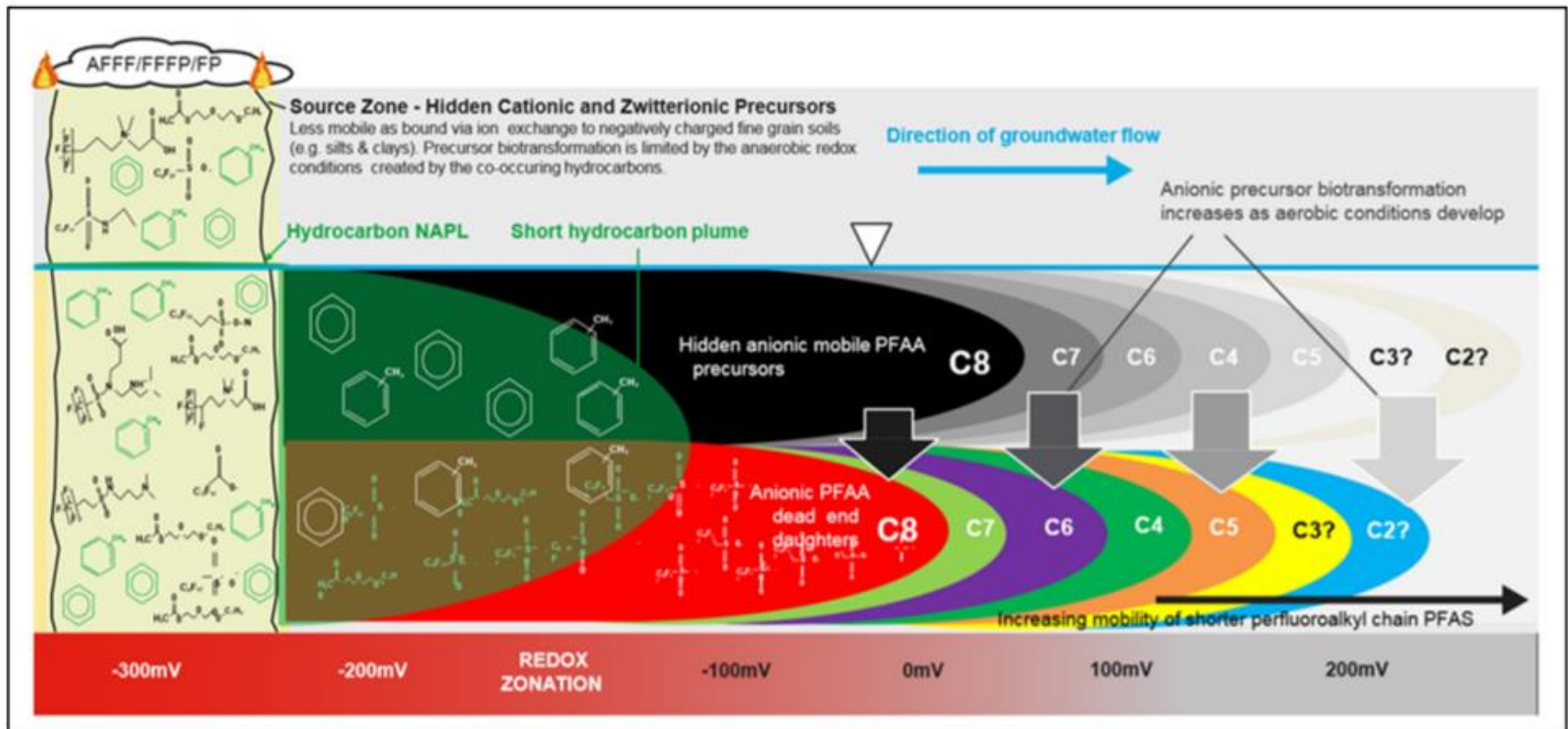
Octane Sulfonate $C_8H_{17}SO_3$



Why are they a problem?



PERSISTANT MOBILE

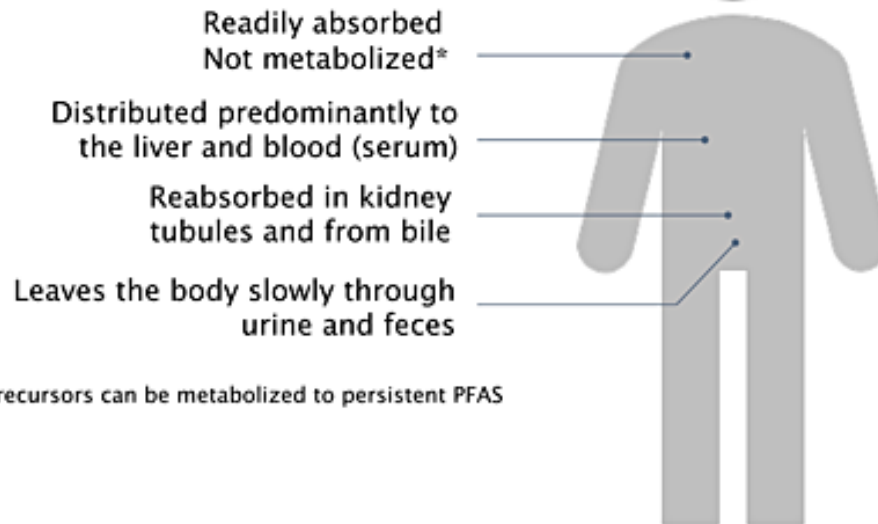


Why are they a problem?




PERSISTANT **MOBILE** **BIOACCUMULATIVE**

Biological Fate PFAAs



* Precursors can be metabolized to persistent PFAS

Long-chain PFAA
elimination half-life
for individuals
exposed:
“One - Several
Years”

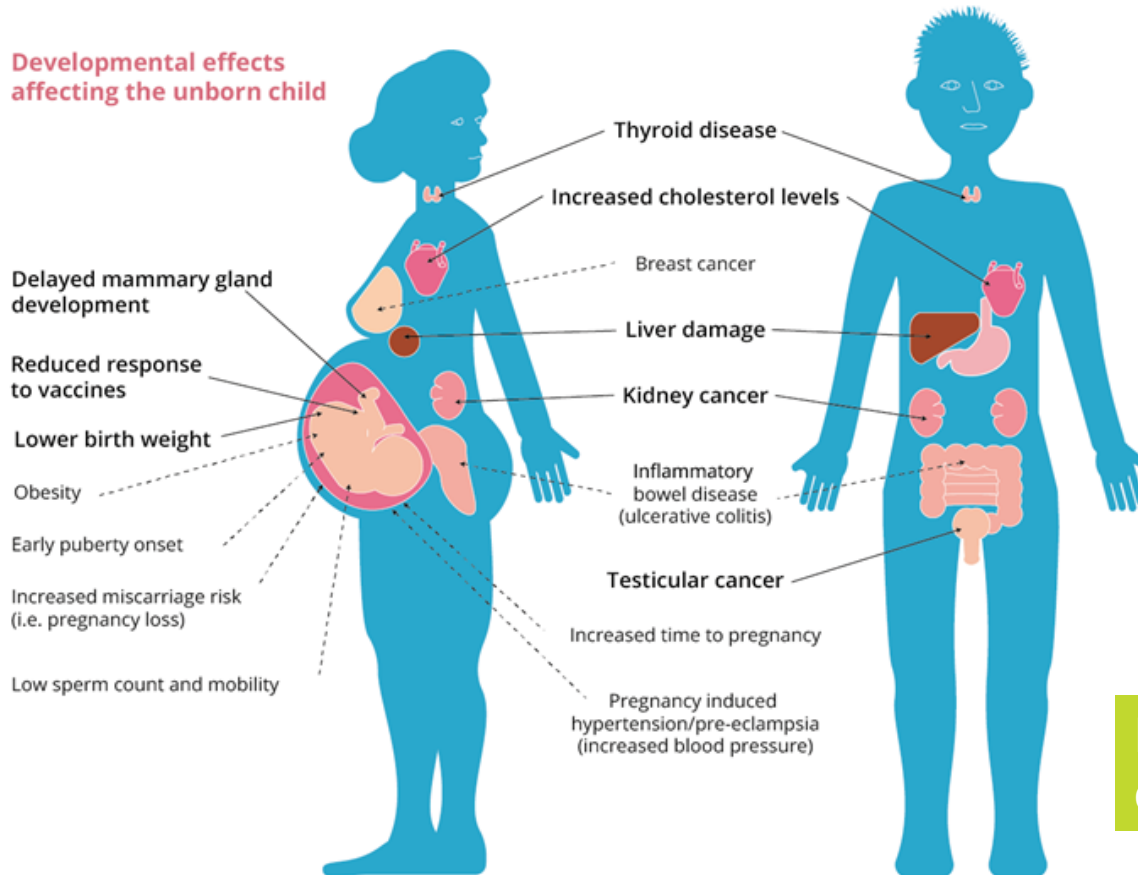
 Crosses the placenta and
has been detected in breast milk

Why are they a problem?



PERSISTANT MOBILE BIOACCUMULATIVE TOXIC

Developmental effects
affecting the unborn child



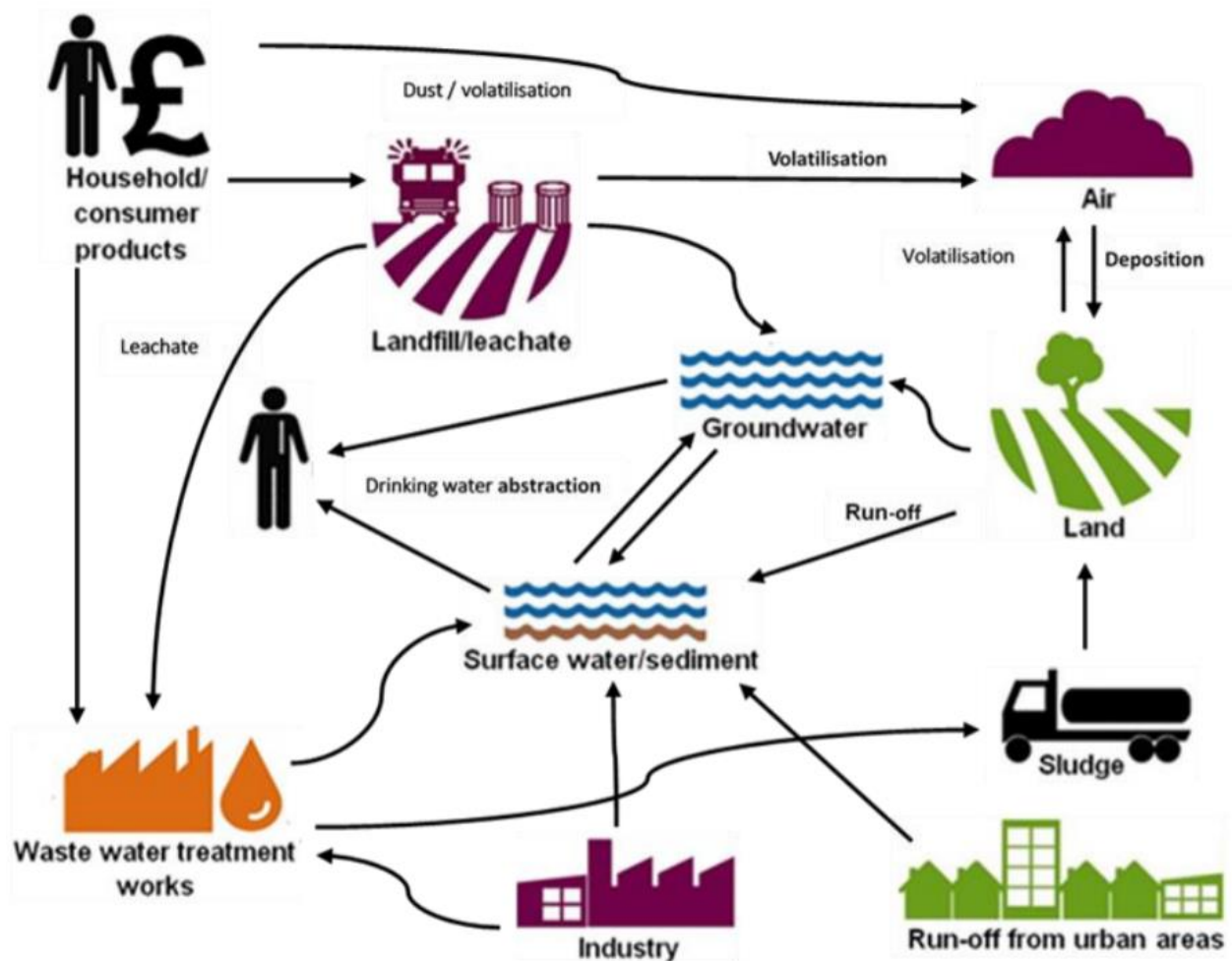
EQS in the ng/L concentrations

Sources: US National Toxicology Program (2016); C8 Health Project Reports (2012); WHO IARC (2017); Barry et al. (2013); Fenton et al. (2009); and White et al. (2011) apud Emerging chemical risks in Europe — 'PFAS'.

PFAS in the Environment



Persistence, high mobility and no regular testing has allowed PFAS to spread throughout the environment





02 Sampling For PFAS

Field Sampling Guidance



- EQS for PFAS is in the ng/L range!
- No official guidance in the UK yet.
 - Had to develop an inhouse sampling guidance
- Ensure plastic sample bottles only – laboratory will provide
- Duplicates and trip blanks
- Ensure sampling equipment is PFAS free
 - No Teflon, blue ice blocks, or other PFAS-containing materials are in contact with the sample
- Ensure no cross-contamination of PFAS in sample from other PFAS sources
 - Clothing, sampling equipment, cleaning products, cosmetic products



Spot the potential source of PFAS Cross-contamination!



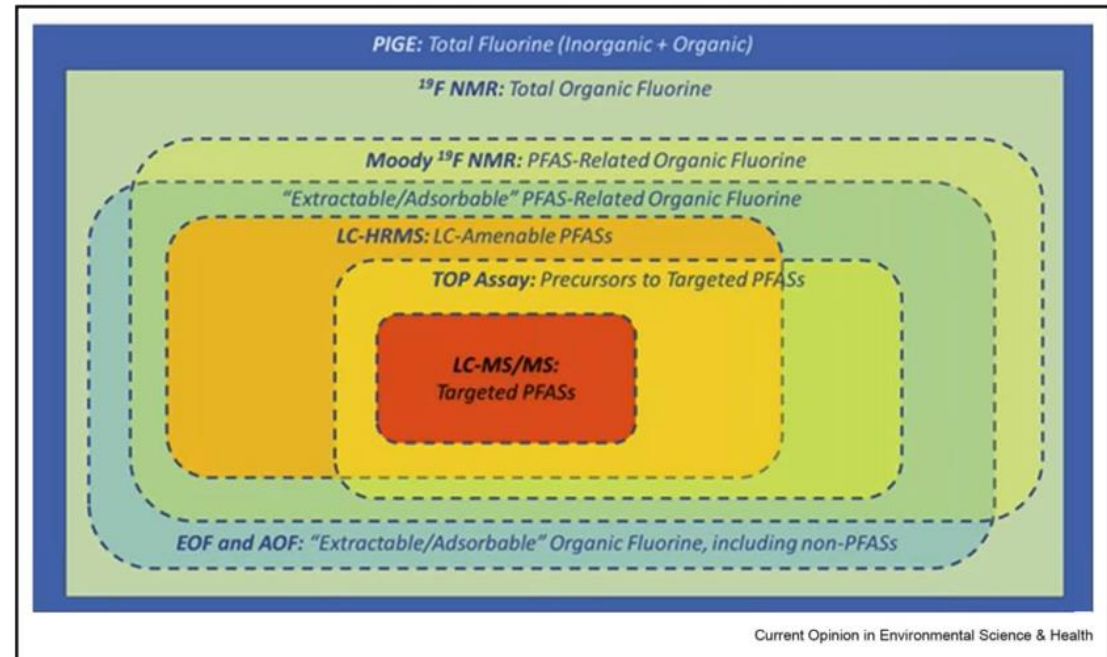
Spot the potential source of PFAS Cross-contamination!



Testing Methodologies



- Targeted PFAS analysis
 - Small number of most common PFAS
- TOPAssay Analysis
 - Indication of detectable PFAS and precursors
- Total Organic Fluorine
 - Detection limit is high



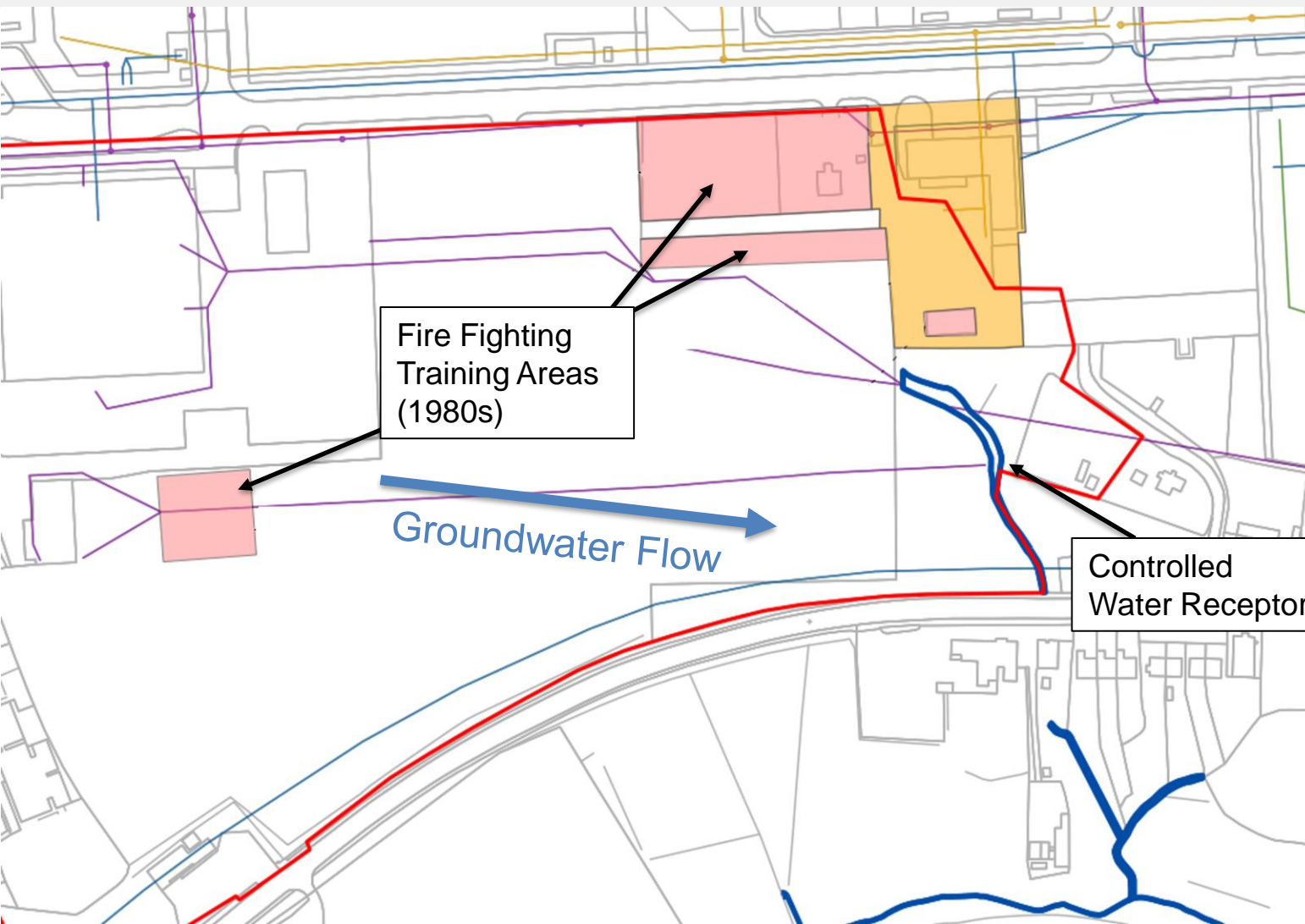
McDonough et al 2018

Currently, UK Laboratories typically offer three main tests: Standard Suite, PFAS-50 and European Union (EU) Drinking Water Directive 20 PFAS compounds and TOPAssay.

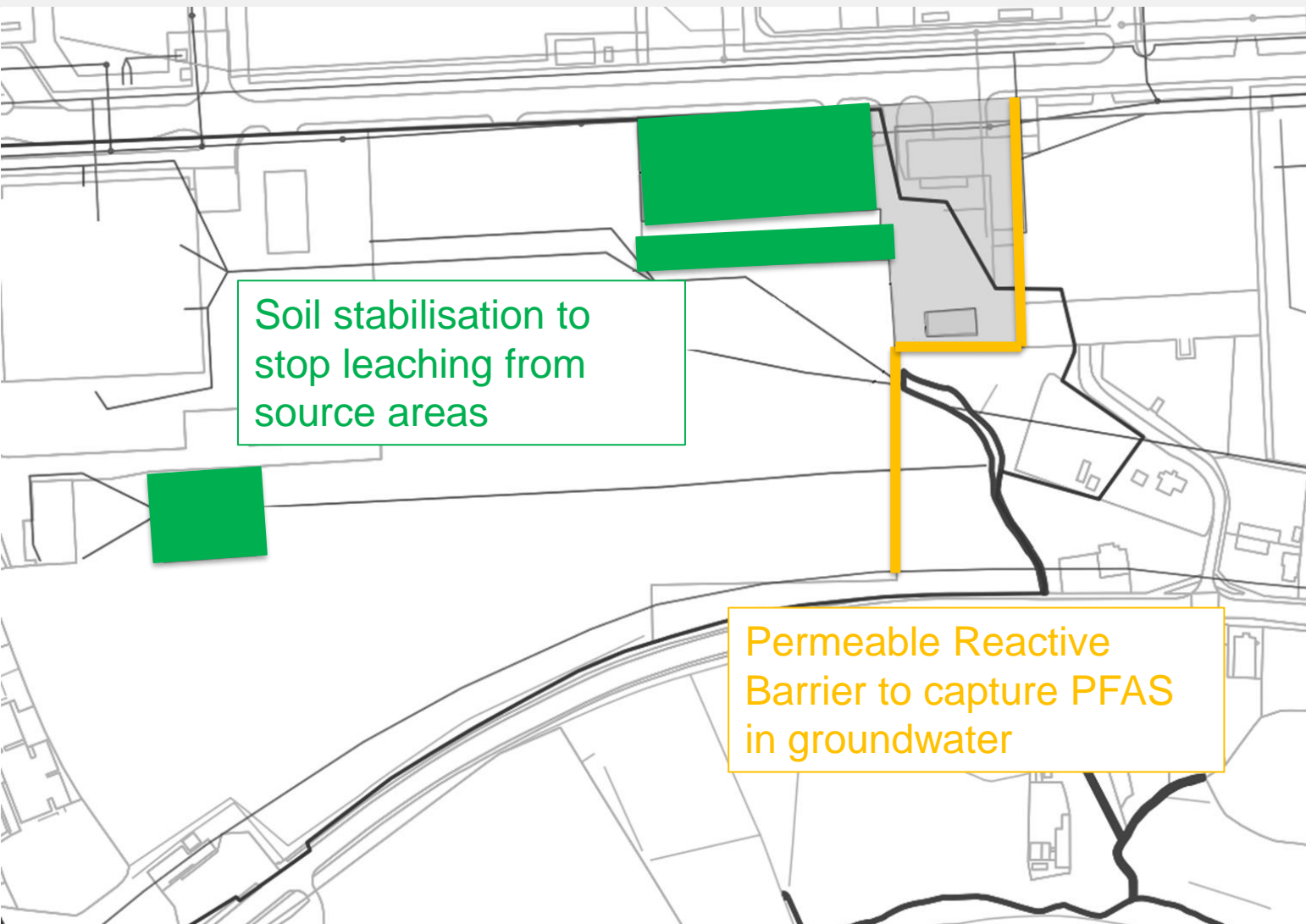


03 PFAS Remediation Design

Anonymous Site A



Remediation Strategy



Soil Stabilisation Trials



- We needed to know what would work in stabilising the residual PFAS in the soils
- Designed and carried out a benchtop trial to test a number of standard and bespoke stabilisation ingredients including commercially available products.
- Of these, Rembind, Granular Activated Carbon and PFA all showed good potential for PFAS sorbancy.
- Other stabilisation products are becoming available

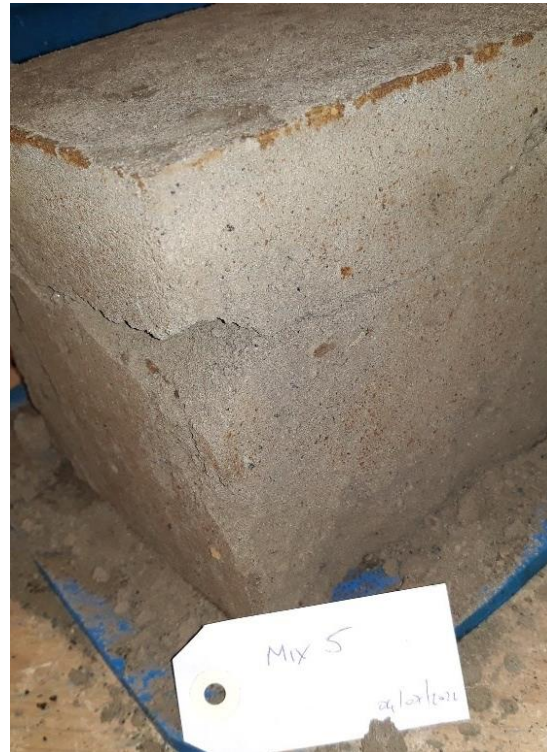


Soil Stabilisation Bench Top Trial



- Seven different blends were made with different stabilisation additives.
- Four cubes were subjected to a 64-day tank test (EA NEN 7375:2004).
- Results confirmed that the PFAS could be stabilized, and the leachate potential reduced by several orders of magnitude.
- Effectiveness of stabilisation depends on the material being stabilized.

Soil Stabilisation Trials



Characterising Permeable Reactive Barrier



- Borehole installation
- Soil and groundwater sampling following PFAS sampling guidance
- Standard and TOPAssay suite testing plus more conventional testing for other COCs
- In-situ hydraulic conductivity tests
- Flux meter installation and subsequent testing
 - Groundwater flux
 - PFAS flux
 - PFAS flux meters are a specialist product. Only one producer, in Belgium.



Designing Permeable Reactive Barriers



PFAS Flux Meters after 6 weeks in groundwater wells



04 PFAS – Impacted Concrete

PFAS – Impacted Concrete/Foundations



- Traditionally crush and re-use concrete on site
- PFAS can adsorb to concrete and in cracks
- PFAS-impacted concrete can remain a long term source
- Options for concrete remediation do exist.
- How do we prove that the concrete is suitable for re-use?
- If not, it will have to be sent for disposal (Persistent Organic Pollutant).



PFAS – Impacted Asphalt/Tarmac



- It is possible to test this material for PFAS using standard and TOPAssay suites
- Testing requires a leachate sample followed by dilution to analyse (due to high concentrations of other contaminants)
- Will we actually detect PFAS if sample requires substantial dilution?





05 Takeaway Thoughts

Takeaways Thoughts



Due to its mobile nature, PFAS is likely to be everywhere. It should be considered on every site as part of a desk study at minimum.

Testing for PFAS is problematic. Always remember that we can only detect what we can test for. Testing results are potentially only a small part of what is really there.

Sampling methodologies require consideration and planning. **Any cross-contamination can mean the difference between a clean sample and a significant problem.**

Remediation methods exist and are widely used in different countries.

Takeaways Thoughts



PFAS used to
make pizza boxes
grease resistant

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