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PFAS source zone stabilization: a zero-waste solution to a global problem

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PFAS Source Zone Treatment

Talk outline:

1. The anatomy of a PFAS Source Zone
2. Zones within zones – what needs to be treated where
3. SourceStop Technology introduction
4. Usage scenarios
5. Lab-scale tests
6. Pilot trials
7. Full-scale examples

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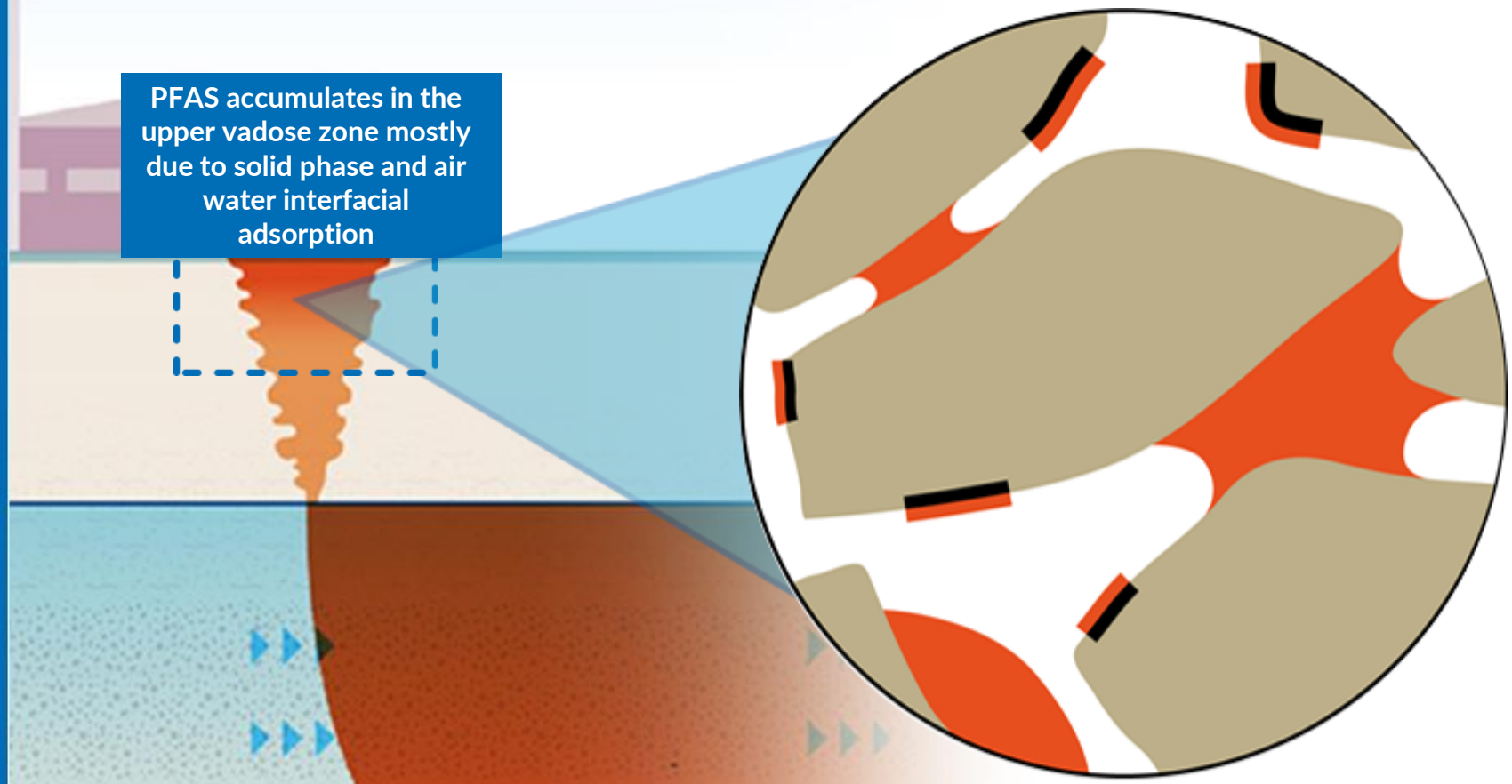
Understanding PFAS Source Zones

PFAS Source Zones: Vadose Zone

PFAS accumulates in the upper vadose zone mostly due to solid phase and air water interfacial adsorption



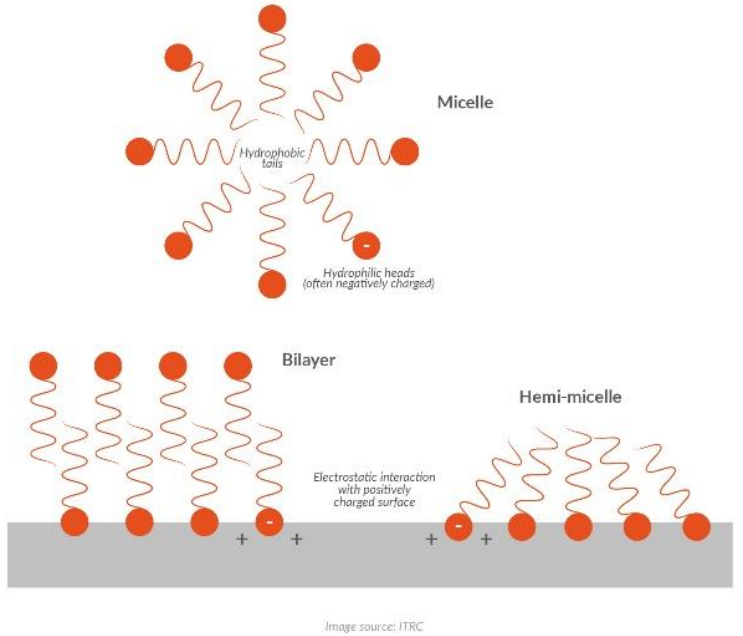


Image source: ITRC

- Soil particle
- Air
- Natural occurring carbon (FOC)
- PFAS-contaminated water

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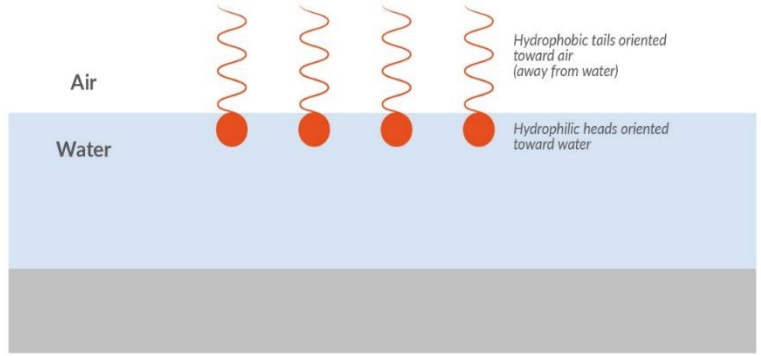
Understanding PFAS Source Zones

PFAS Source Zone: Capillary Fringe and Groundwater

Accumulation in capillary fringe due to air water interfacial adsorption

Source zones discharge =
- local high concentrations
- plume development



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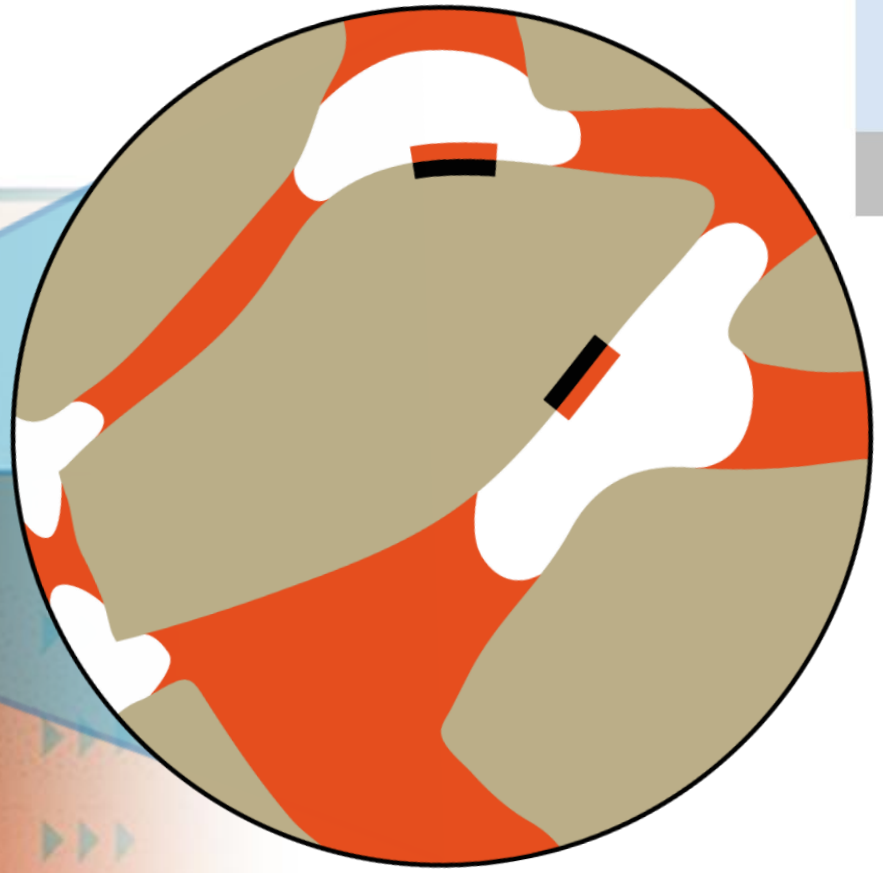

Soil particle

Air

Natural occurring carbon (FOC)

PFAS-contaminated water

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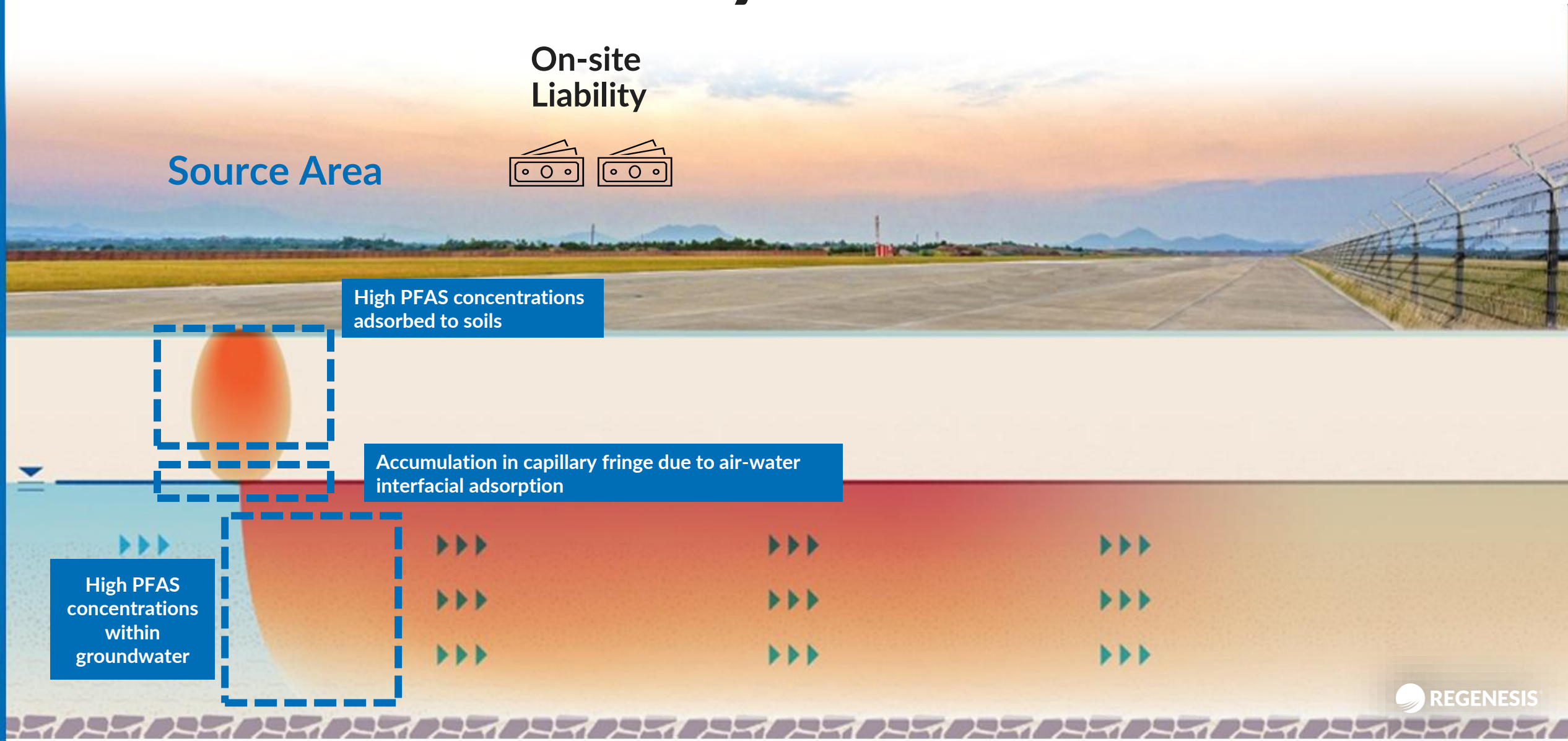
Understanding PFAS Source Zones

PFAS Source/Plume System



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What is Remediation?

"A process used to reduce or eliminate the risk for humans and the environment that may result from exposure to harmful chemicals" *

*Interstate Technology Regulatory Council (ITRC), 2020

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Risk

Risk is eliminated if there is no potential for exposure to a hazard

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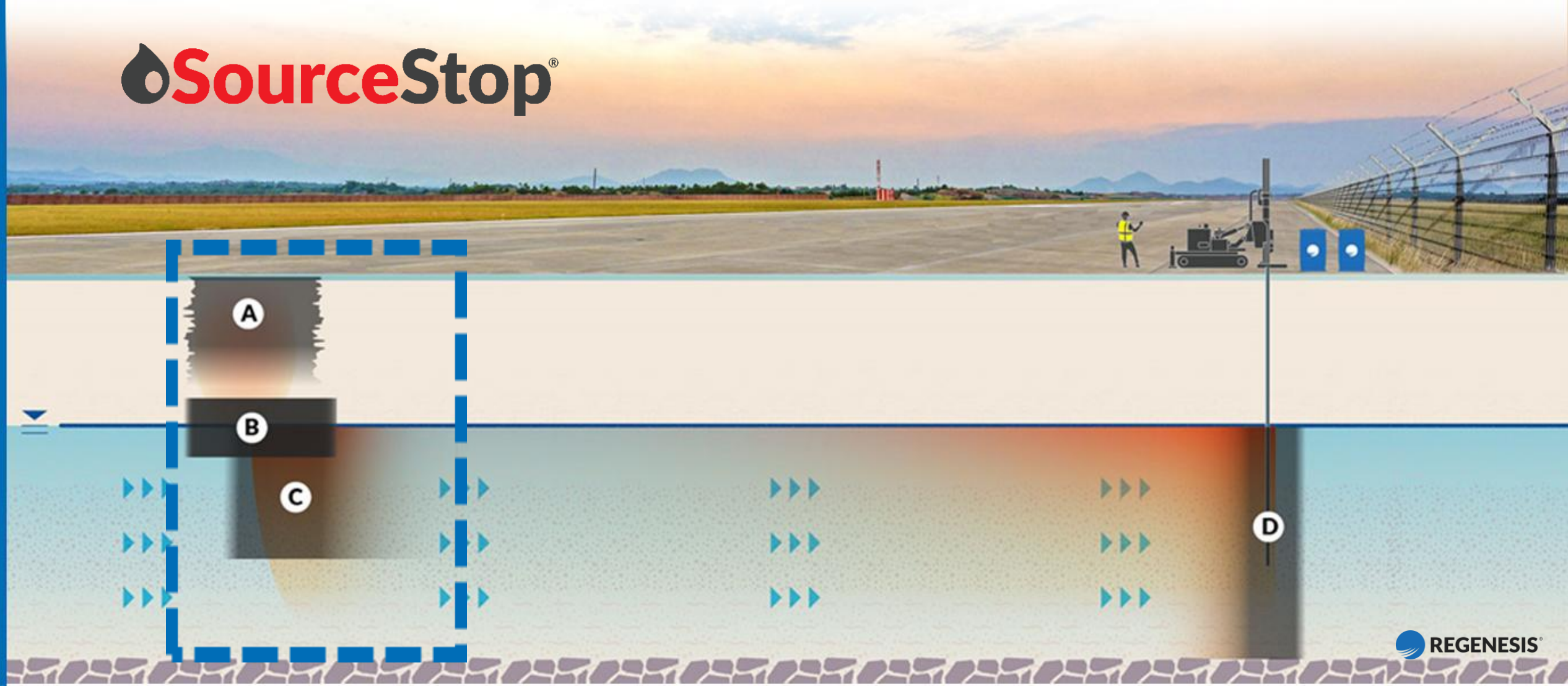
Full-Spectrum Remediation for PFAS

Full-Spectrum Remediation for PFAS



PFAS Source Zone Treatment

SourceStop®

- Stabilises PFAS source areas
- Reduces leaching of soil contamination
- Halts migration of PFAS in groundwater

Available in two formulations:

Liquid

Solid

Both use REGENESIS' Colloidal Activated Carbon

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Distribution and Coating

- When mixed into moist soils:
  - Colloidal Activated Carbon released
  - Enhancing distribution
  - Penetrating and coating soils
    - Important for silty/clayey soils
  - Rapidly effective
  - Easy visual confirmation minimizes mixing time and cost

SourceStop®

Application Approaches & Usage Scenarios

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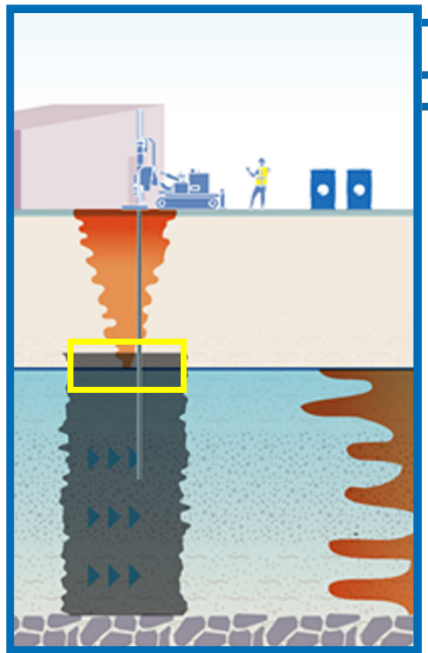
SourceStop

Dust Minimization

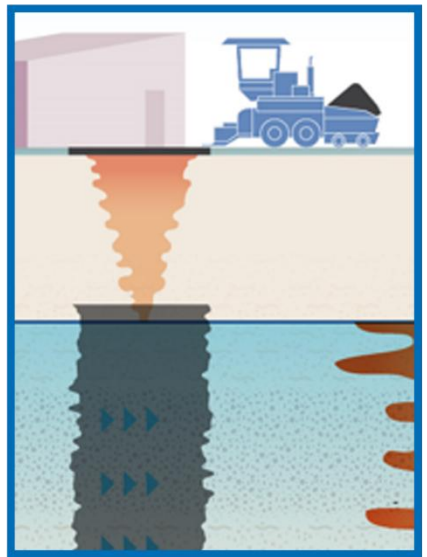
- **Designed to minimize dust**
  - Safe and easy handling
  - No mess
  - No need for dust suppression
  - Engineered to avoid this…
  - And provide this!

Application Approaches & Usage Scenarios

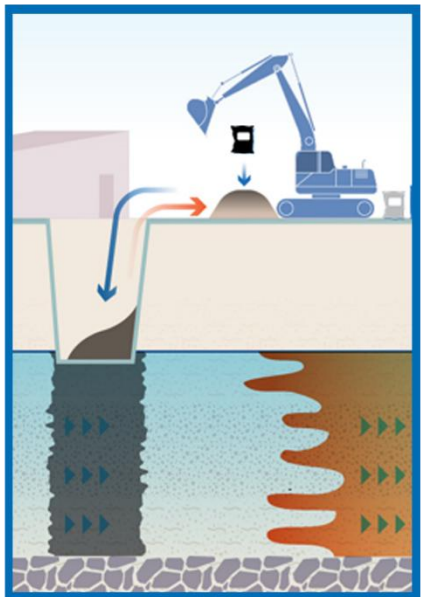
Source Treatment Options



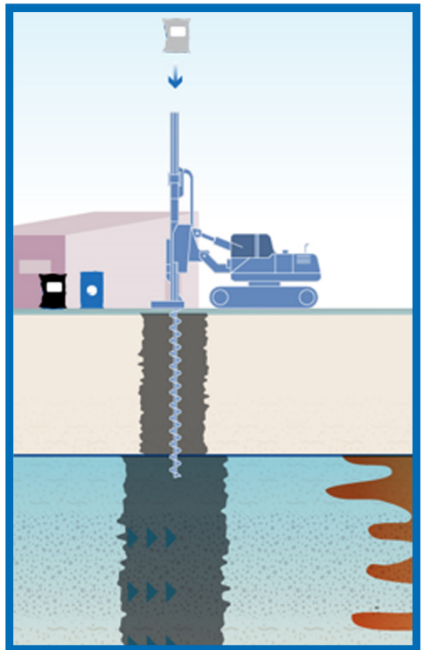
SourceStop Liquid injection



Physical capping



Ex situ vadose zone treatment – SourceStop Solid



In situ vadose zone treatment SourceStop Liquid and Solid

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Laboratory Testing

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Laboratory Testing

Demonstrating the Benefits of CAC

Control Sample

PAC Treated Sample

SourceStop Treated Sample

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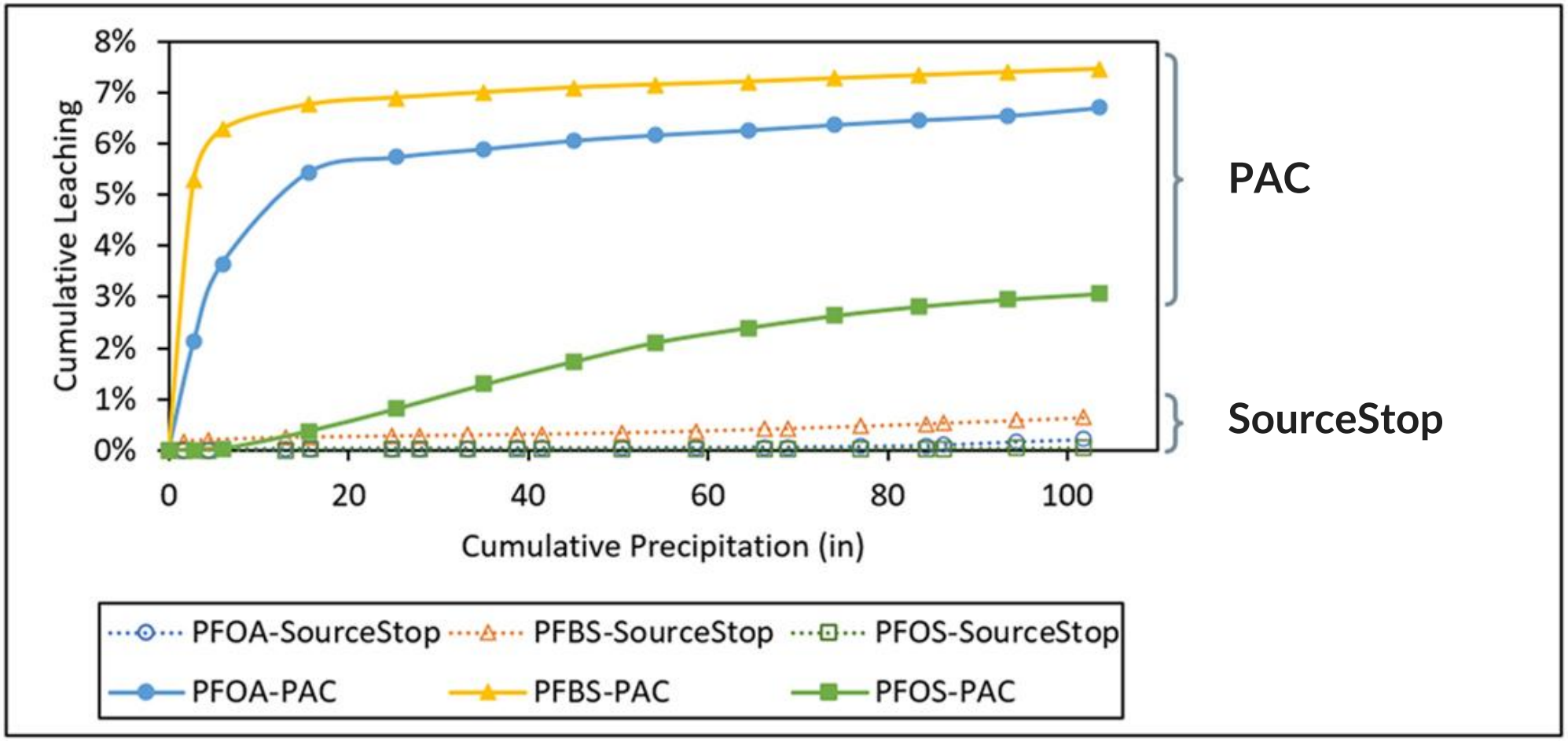
Laboratory Testing

Infiltration and Leaching Simulation

PAC and SourceStop



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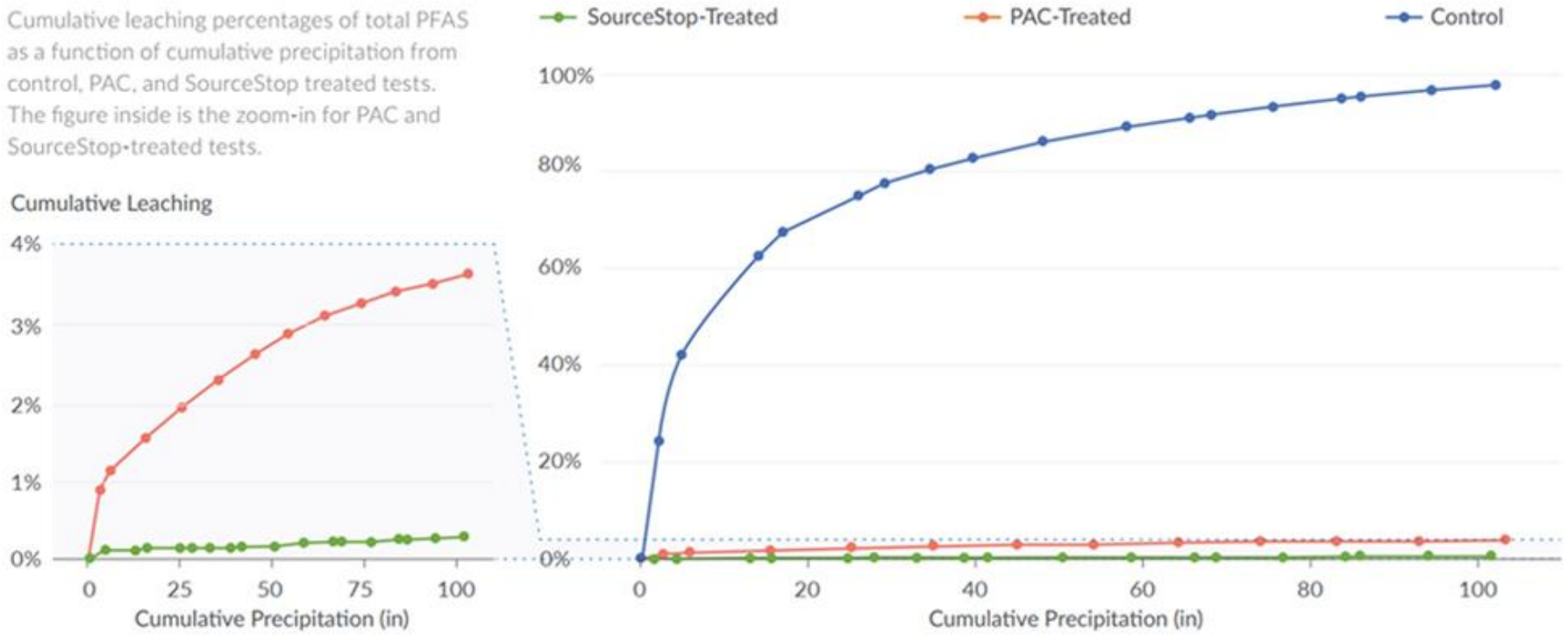
Laboratory Testing

Infiltration and Leaching Simulation

Cumulative leaching percentages of total PFAS as a function of cumulative precipitation from control, PAC, and SourceStop treated tests. The figure inside is the zoom-in for PAC and SourceStop-treated tests.



- Leached mass was reduced to 0.3% using SourceStop
- SourceStop reduction Order Of Magnitude >> PAC due to particle size
- Effective across a range of PFAS compounds

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Beta Testing

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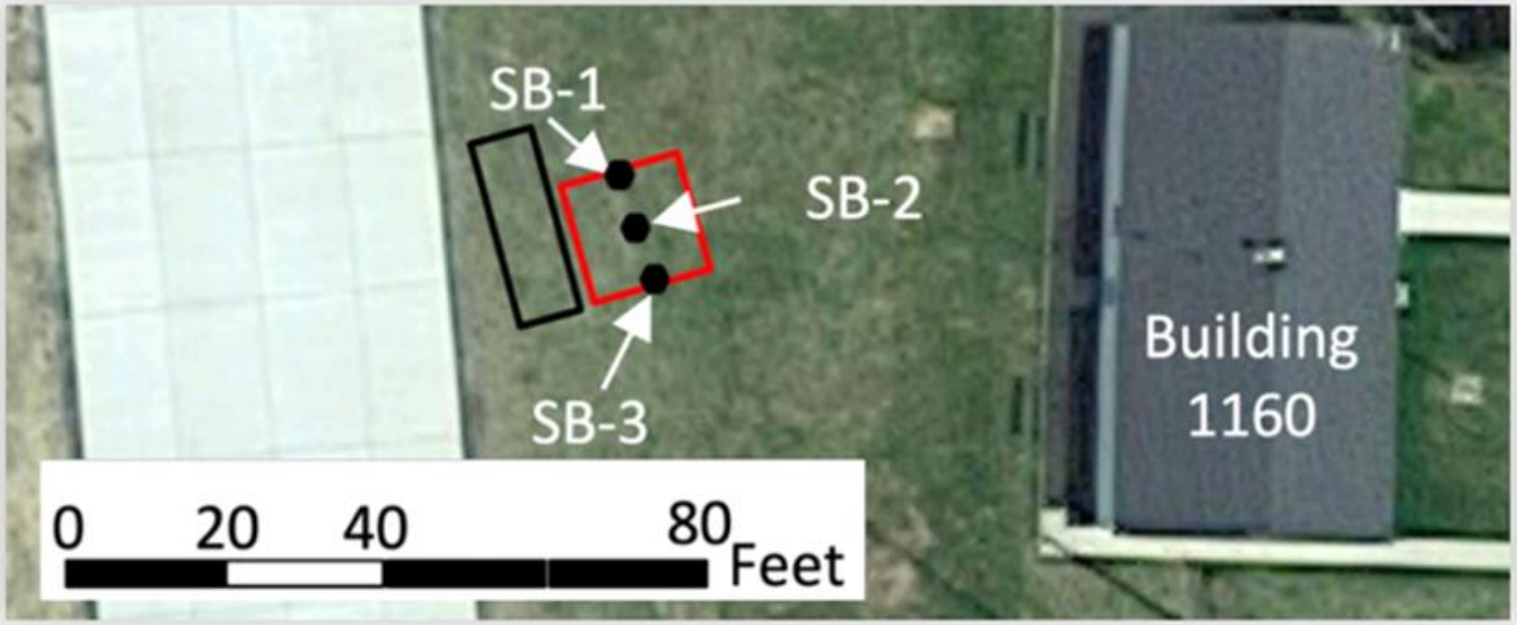
Beta Site Testing & Field Implementation

Source Treatment - Grayling, MI



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Beta Site Testing & Field Implementation

Source Treatment - Grayling, MI

Application Details

Location	Michigan
Treatment Area	20m^2
Soil Volume Treated	0 – 3 m BGL:
Max. Total PFAS in Leachate	64 m^3
Surficial Geology	Sand, topsoil cover
Implementation Date	September, 2022

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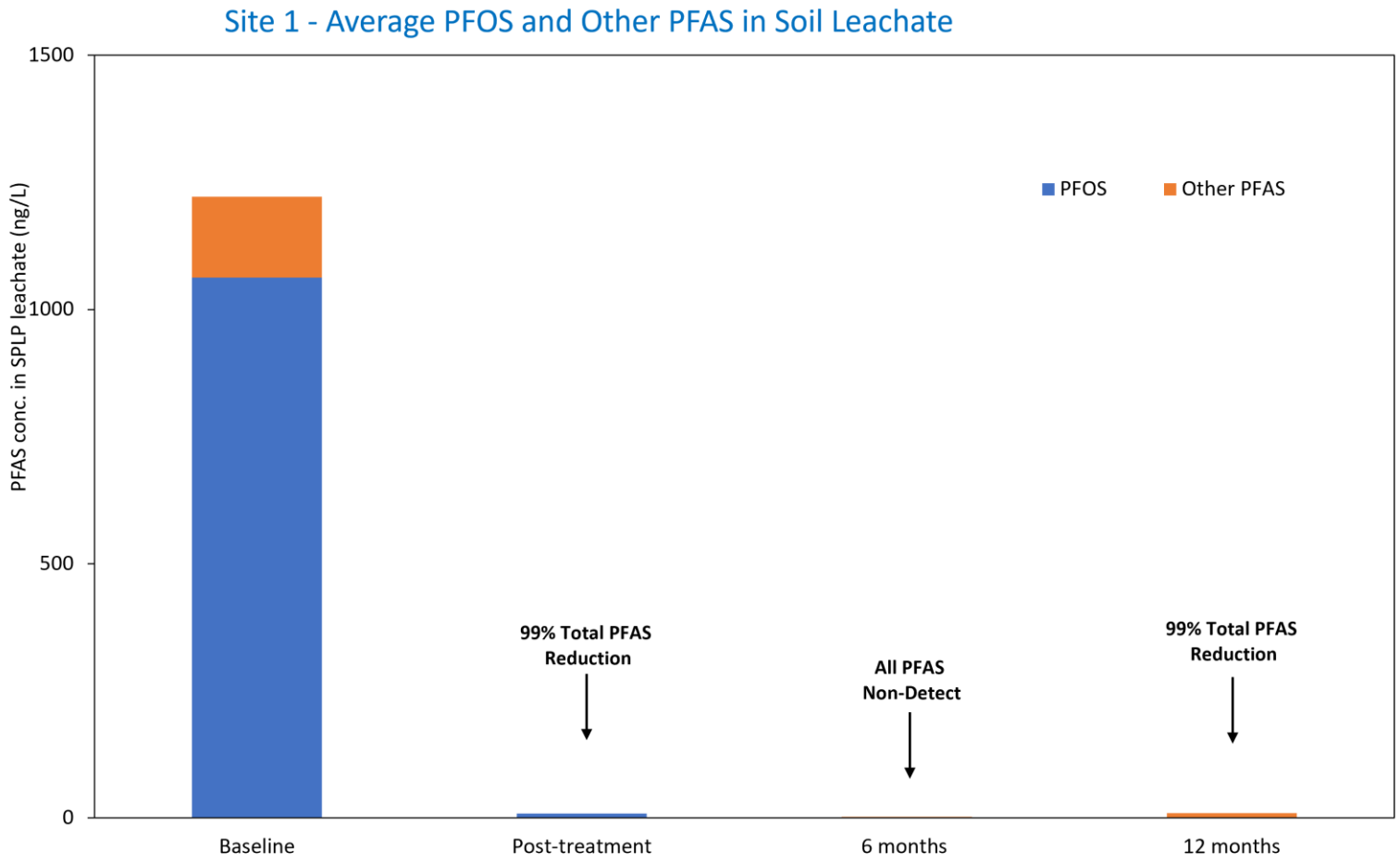
Beta Site Testing & Field Implementation

Source Treatment - Grayling, MI

Avg. PFOS/PFAS in Soil Leachate

Average PFOS and rest of PFAS concentrations in soil leachate at baseline and post-treatment at Site 1.

- PFOS
- Rest of PFAS



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Pilot Studies

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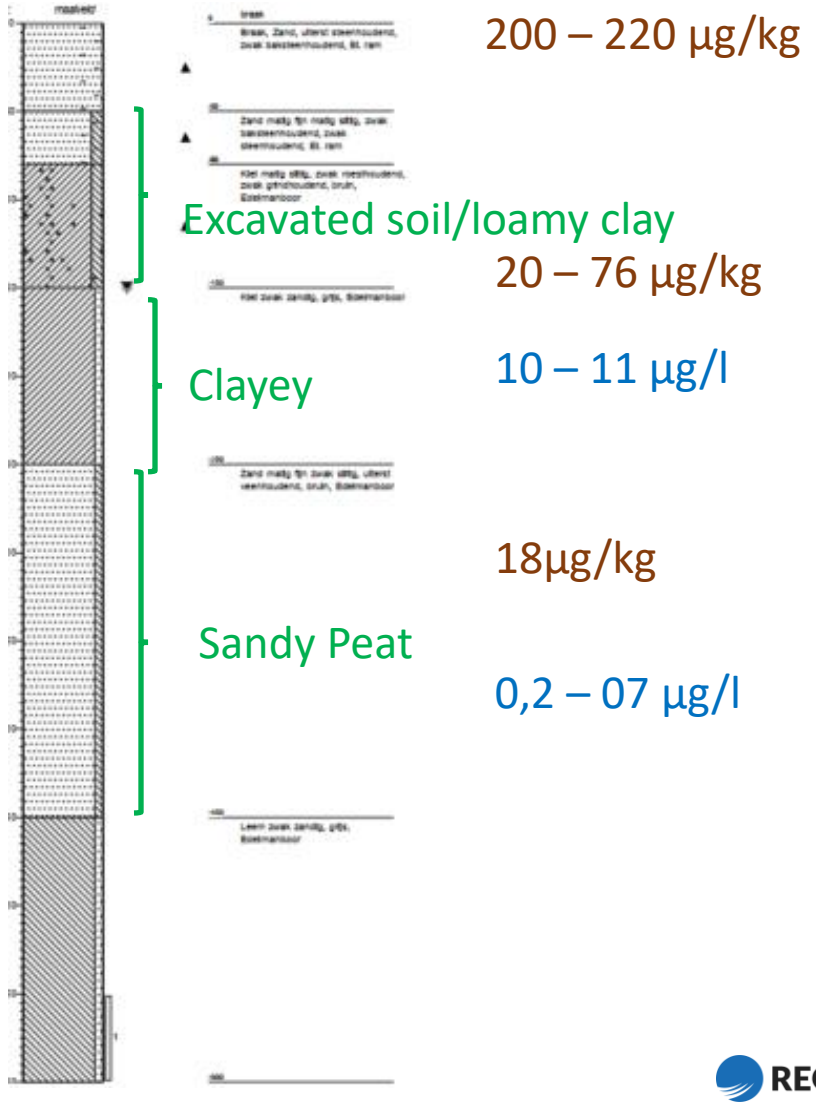
Beta Site Test & Field Applications

Source Treatment – Belgium

- Industrial Site – No AFFF
- PFAS Spill
- Heterogeneous Geology
- Concentrations
  - Soil: dominant 6:2FTS – 10:FTS minor constituents C4 – C9 carboxylic acids (PFOS)
  - Groundwater: primary 6:2FTS – 8:FTS in C4 – C9 carboxylic acids (no PFOS)
- Injection of SourceStop Liquid in the capillary and the saturated zone
  - 'Proof of concept'
  - Stop leaching to sand beneath



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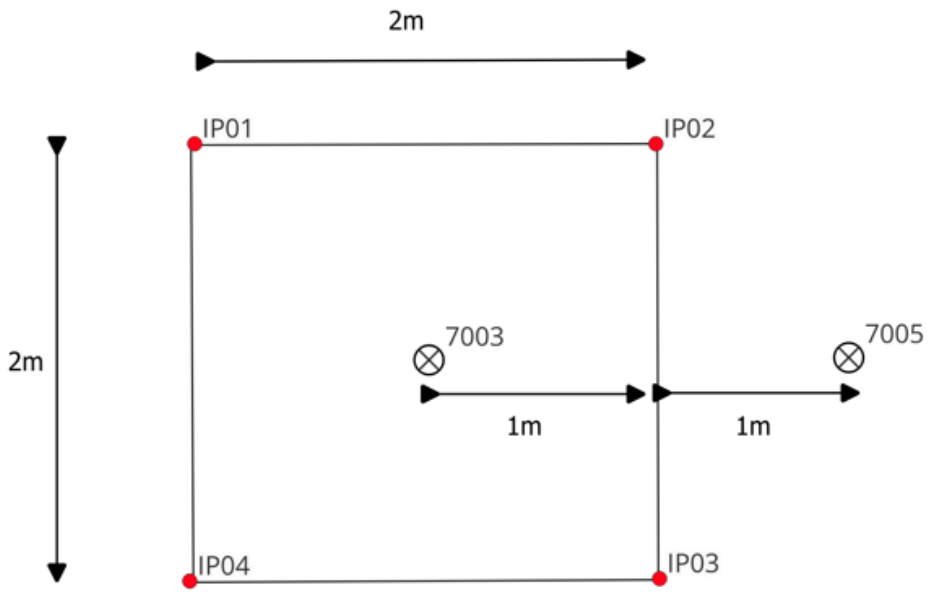
Beta Site Test & Field applications

Source treatment – Belgium (Pilot)



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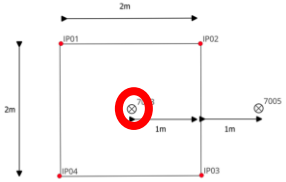
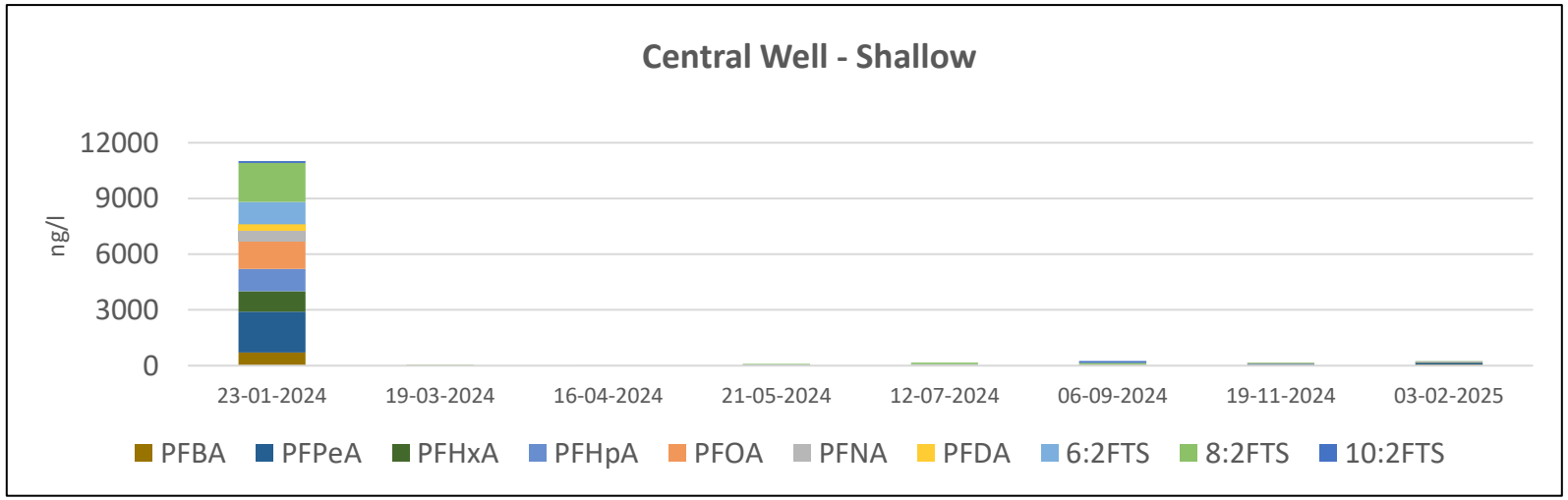
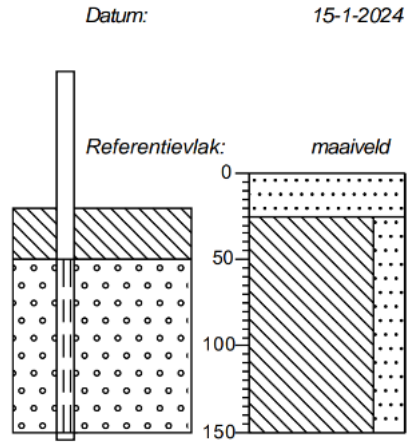
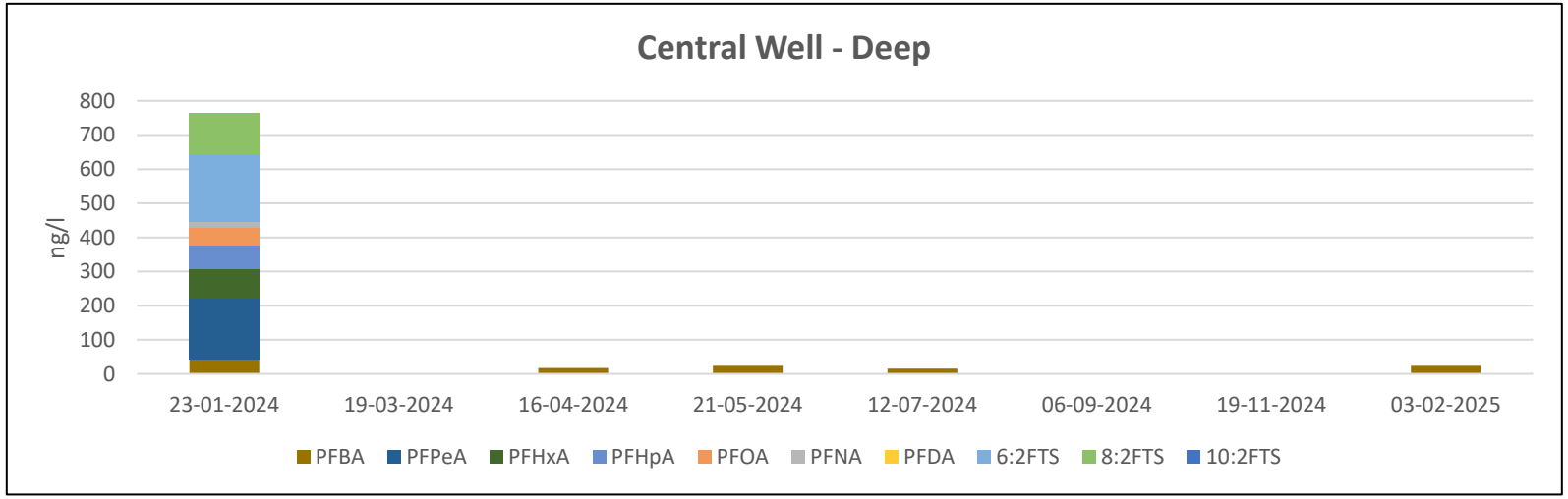
Beta Site Test & Field applications

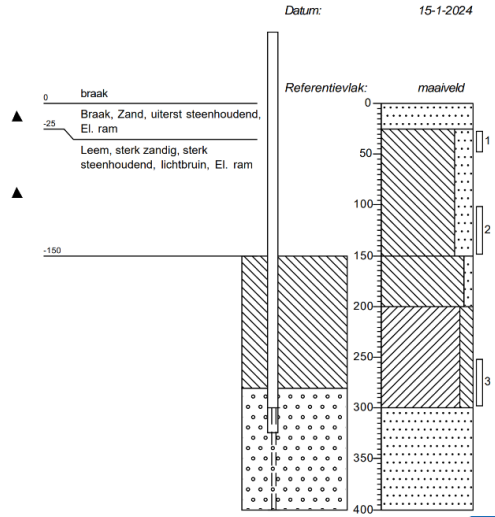
Source treatment – Central Well Results











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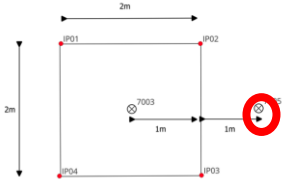
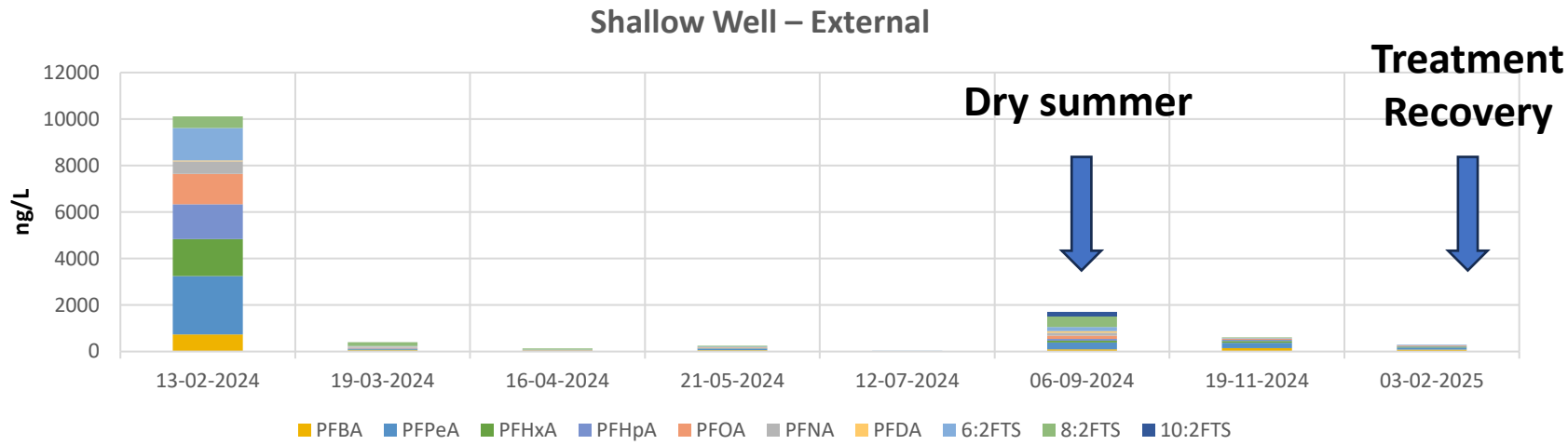
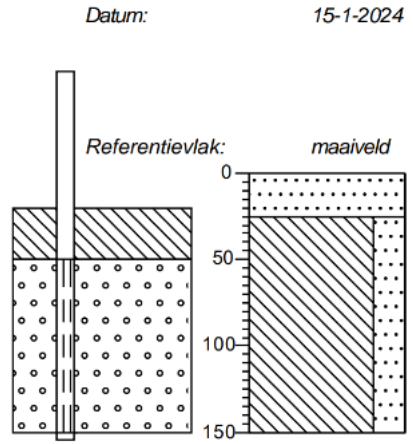
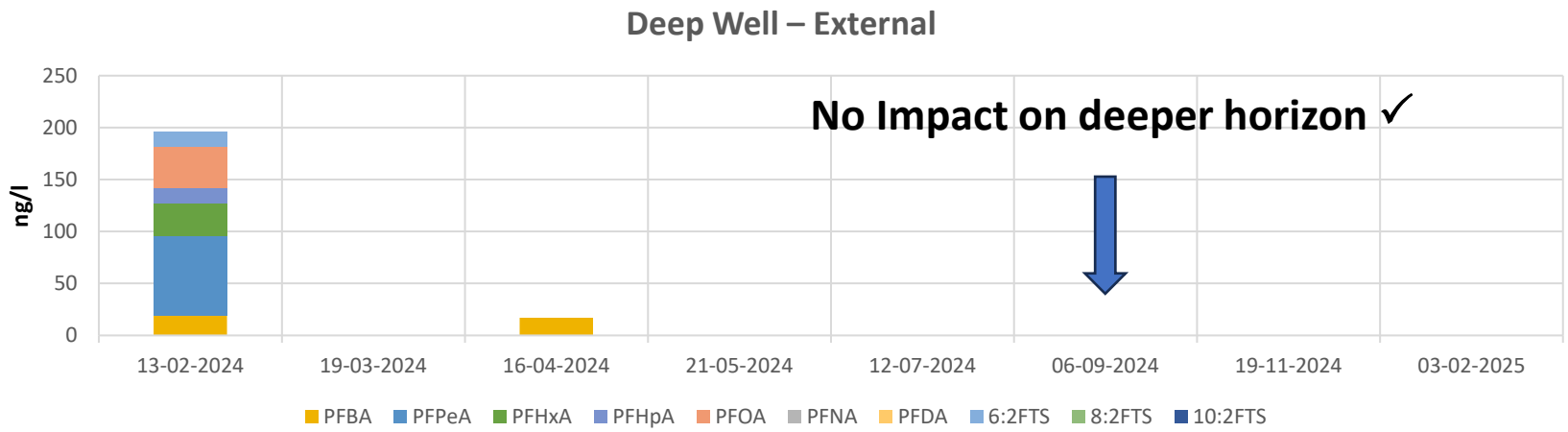
Beta Site Test & Field applications

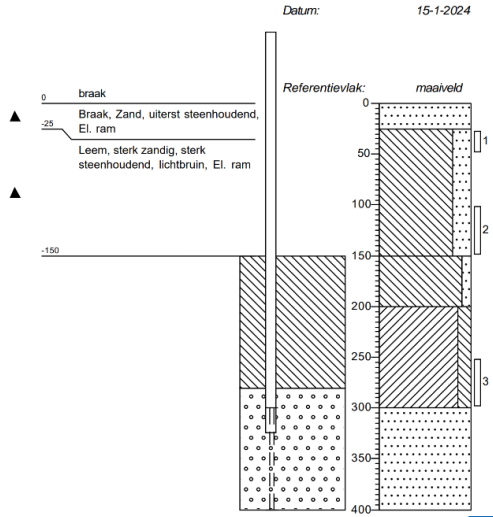
Source treatment – External Well Results











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Full Scale Application – Trenching

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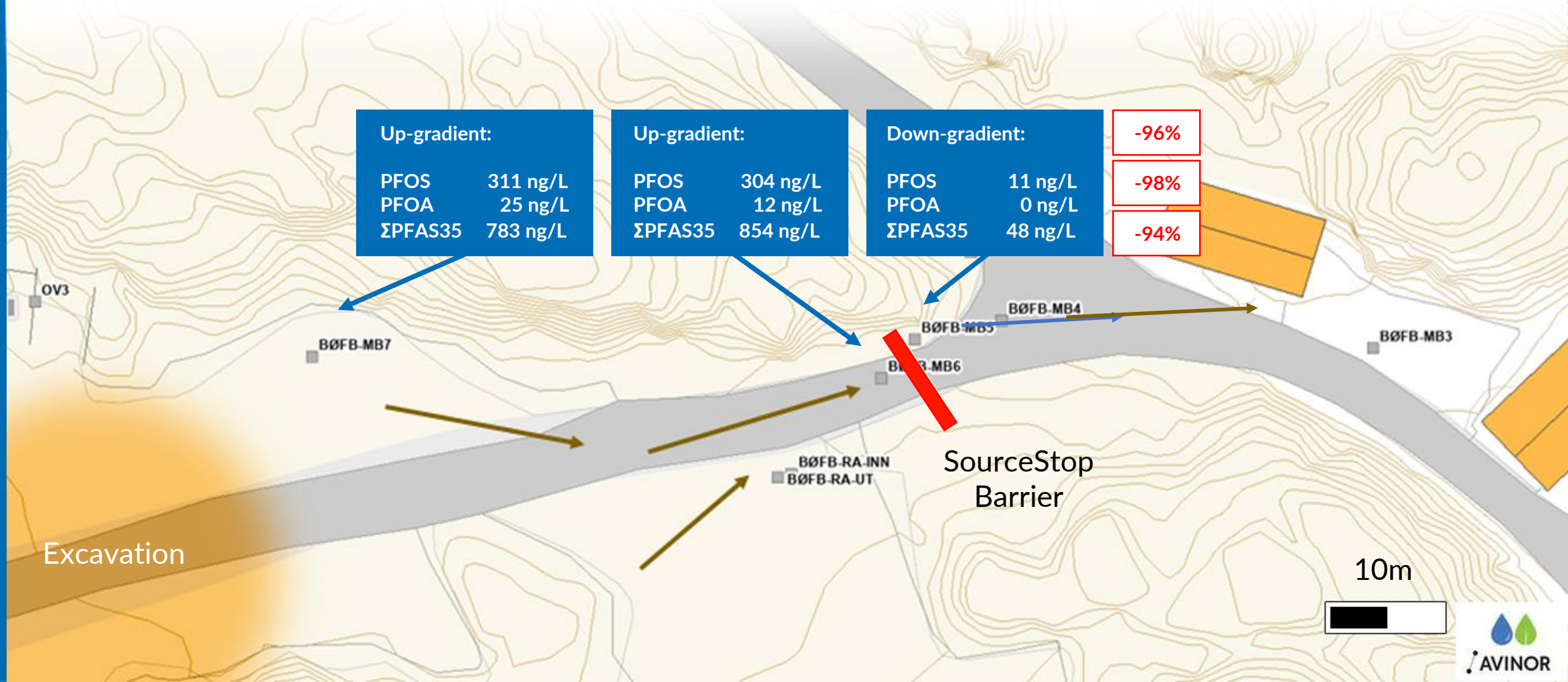
Field applications

Trench Application – Norway

Beta Site Testing & Field Implementation

Norway Results

Mean concentrations – monthly sampling over 9 months post application



Summary

Emerging as the default solution for PFAS contaminated sites

- Adaptable technology which can be used in a verity of settings
- Proven to achieve and maintain EPA MCLs
- No PFAS waste generated
- Taken from lab to commercial scale

Questions?

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