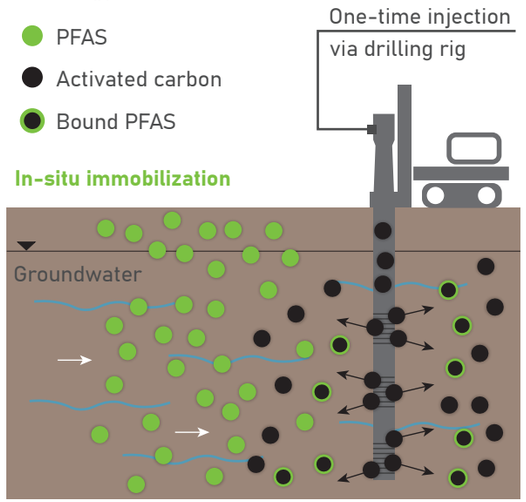
In-situ/on-site immobilization

When applying immobilization techniques, PFAS are bound directly in-situ or on-site to permanently **stop them from mobilizing into the water phase or spreading with the groundwater**. High-performance PFAS adsorbents such as specially activated carbons are used for this purpose.

In the on-site application the activated carbon is simply mixed with the contaminated soil. For the in-situ application however, we utilize our specially developed **TSE®** (=targeted solids emplacement) technology.



The TSE® technology enables the targeted injection of granular activated carbon directly into the subsoil, regardless of its hydraulic absorption capacity. The injection of the activated carbon in a highly viscous suspension enables large ranges and input quantities.

The in-situ immobilization is best combined with the biopolymer-enhanced in-situ elution to treat the source zone. **The combination of both techniques offers the greatest possible process reliability for in-situ treatment.**

How do we realize your project?

The basis for any successful PFAS remediation measure is a good knowledge of the extent of the contamination and the subsurface situation. The most suitable treatment strategy is identified as part of a **feasibility study** in our process engineering laboratory.

On this basis, we prepare an **individually tailored offer** for a full-scale remediation.

We carry out the technical implementation of the remediation with our own teams and technology until the remediation objectives have been achieved.

Adsorbentia

- Solids to whose surface molecules/ atoms from a liquid or gas adhere
- Surface adhesion is caused by physical or chemical forces

How is the project success measured?

The effectiveness of PFAS in-situ remediation is assessed by the elimination of PFAS in soil, soil eluate, groundwater or leachate water. These analyses are usually provided by independent experts as part of a monitoring process.

Moreover, our technologies ensure that soil fertility and other important soil functions are not negatively affected by the biopolymer-enhanced PFAS elution.

At the same time, we carry out our own - partially sensor-based - process monitoring, with which the PFAS elution is controlled using various parameters.

Good process monitoring is a prerequisite for the desired remediation success.

SENSATEC

We are your competent partner, specialized in soil and groundwater remediation with a focus on PFAS contamination.

With our **20 years of experience** in the field of site investigation and remediation of environmental contaminations, we are proud to be one of the market leaders in Central Europe. Our outstanding expertise is confirmed by more than 400 successfully completed reference projects.

Let's **revitalize our environment** together, so feel free to contact us for a non-binding project inquiry.

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SENSATEC

PFAS remediation

Biopolymer-enhanced elution and immobilization

www.sensatec.de

What are PFAS?

PFAS, or per- and polyfluorinated alkyl substances, are a group of **chemicals** used in many everyday products. They are known to be **mutually hydro- and lipophobic (stain-resistant)**, which is why they are used in products such as coated pans, outdoor clothing, fast food packaging and fire-fighting foams.

The environmental fate of PFAS is dependent on their properties. PFAS are very stable and accumulate in the environment and the human body.
Due to their longevity and their adverse health effects, PFAS are referred to as “forever chemicals”.

What to do if your site is contaminated by PFAS?

Sensatec can help you here.
We offer you a comprehensive range of services:

- **Site investigation**
  Extensive experience in the technical implementation of site investigations using drilling technology
- **Feasibility studies in the laboratory**
  Knowledge from numerous laboratory feasibility studies on the remediation of PFAS contaminated soils and groundwater
- **Site-specific remediation plan**
  Realization of technical remediation planning and support in the preparation of necessary permits
- **Remediation techniques**
  Biopolymer-enhanced PFAS elution from contaminated soils and/or permanent immobilization of residual PFAS contamination in the soil
- **Process monitoring**
  Through a variety of monitoring parameters (partially sensor supported) we ensure an optimal process execution

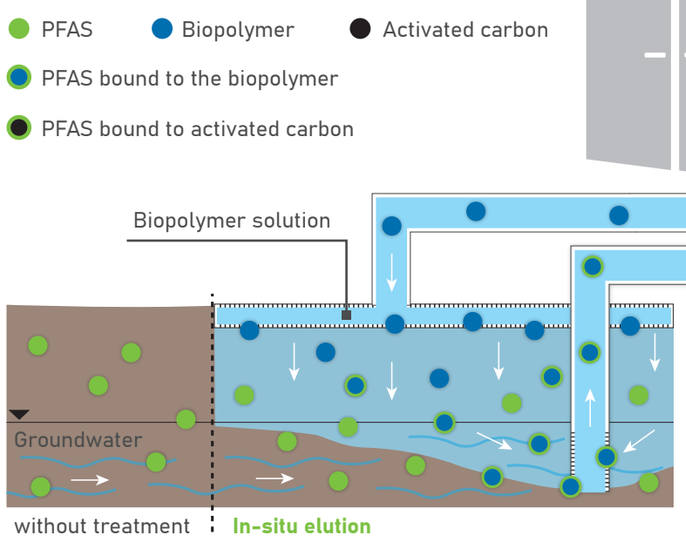
Methods

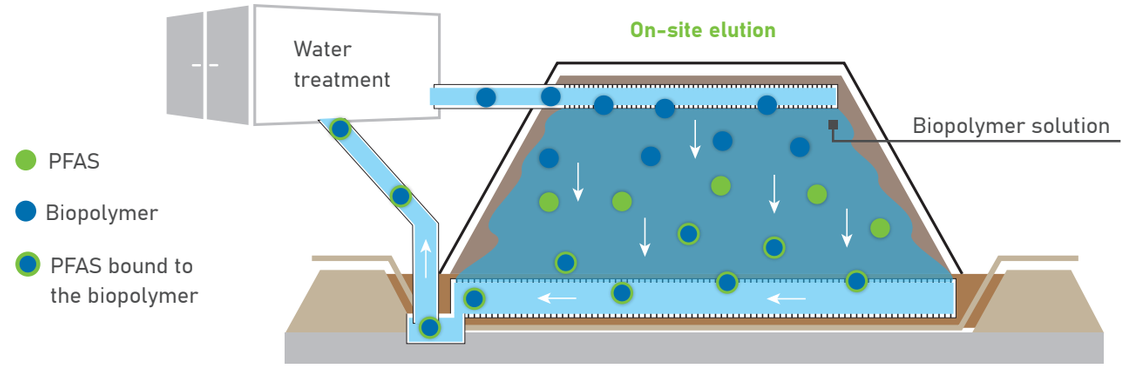
- In-situ elution
- On-site elution
- In-situ/on-site immobilization

In-situ elution

In this process, the **contaminated soil is flushed with an aqueous biopolymer solution**. The PFAS are hereby transferred from the soil particles into the aqueous solution, thus cleaning the contaminated soil. The PFAS eluted into the groundwater are then fully removed using one or more extraction wells. The resulting process water with a high PFAS content is purified in a special water treatment plant.

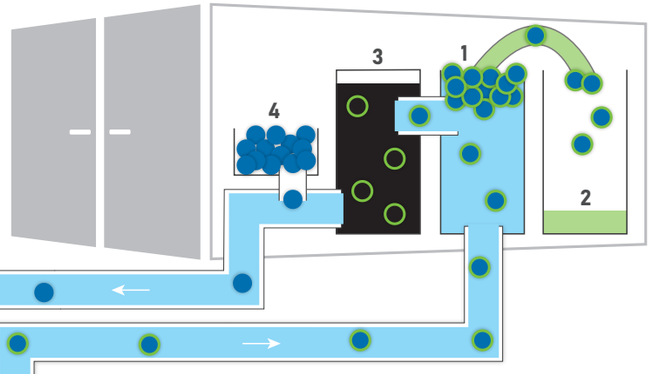
The waste product of the water treatment, the PFAS concentrate, is ultimately thermally destroyed so that the **PFAS are completely removed from the natural cycle**. The purified water can then be recycled in the elution process for e.g. irrigation.





Biopolymers

- Surface-active substances
- Readily biodegradable
- Amphiphilic
- Main components: Amino acids, sugar compounds, fatty acids and lipids



Steps of water treatment:

1) Polymer/PFAS flotation (separation)
2) Concentrate for thermal disposal
3) Water treatment with activated carbon
4) Purified water is again dosed with biopolymers and reused

On-site elution

This method follows the **same leaching principle as in the in-situ elution**, but here the **contaminated soil is excavated first**.

The excavated material is assembled in soil piles on a sealed surface. The piles have a height of approx. 2-3 m and are equipped with irrigation tubes, a central water collection system as well as sensors for remote monitoring. Operation is largely automatic. Biopolymer solution is continuously applied to the pile through the irrigation system. By passing the contaminated soil the biopolymer solution takes up the PFAS and is hence cleaning the soil.

The PFAS-containing washing solution is collected, purified and then returned to the cycle with biopolymers. The process is carried out until the PFAS concentration in the soil has reached target levels.

Elution

- Dissolving, removing or displacing adsorbed substances from adsorbents or ion exchangers or in this case soil particles