GROUNDWATER QUALITY 2025

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Study of PFAS pollution affecting a groundwater pumping site in a chalk aquifer (Mons – Belgium)

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Context

Project Background

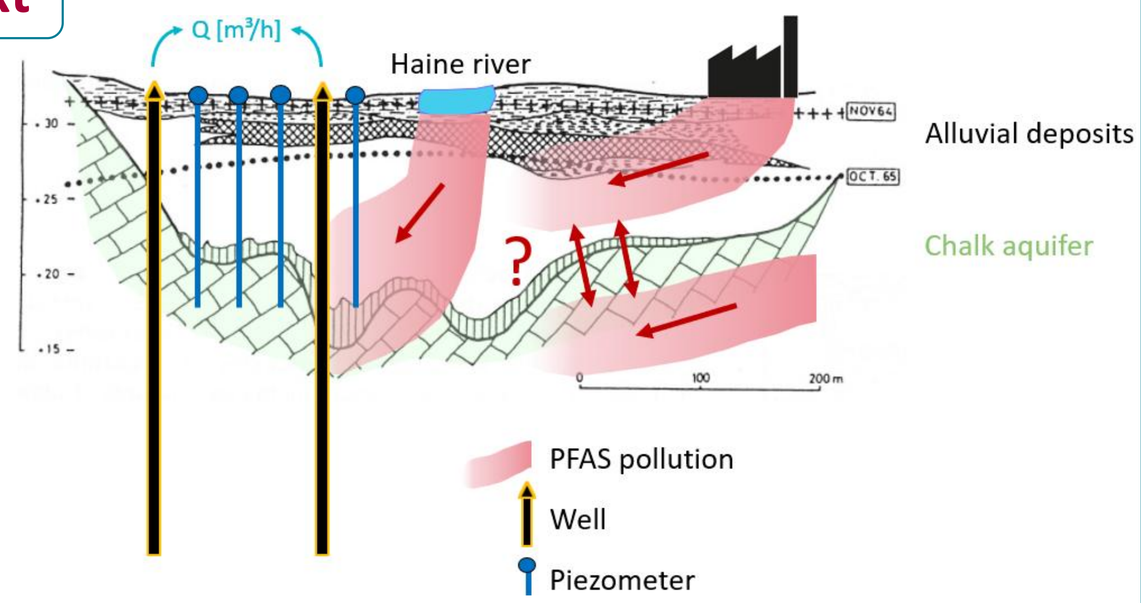
The chalk aquifer of the Mons Basin is extensively used for both drinking water and industrial supply. A significant portion of the water is pumped by the intermunicipal company VIVAQUA and exported to the Brussels area, which is highly dependent on it. In recent years, PFAS contamination has been detected in several areas of the aquifer, with concentrations exceeding the upcoming European drinking water standard (0,1 µg/L for the sum of 20 PFAS). Major water catchments operated by VIVAQUA, as well as by other water producers, are affected by this pollution.

Objectives

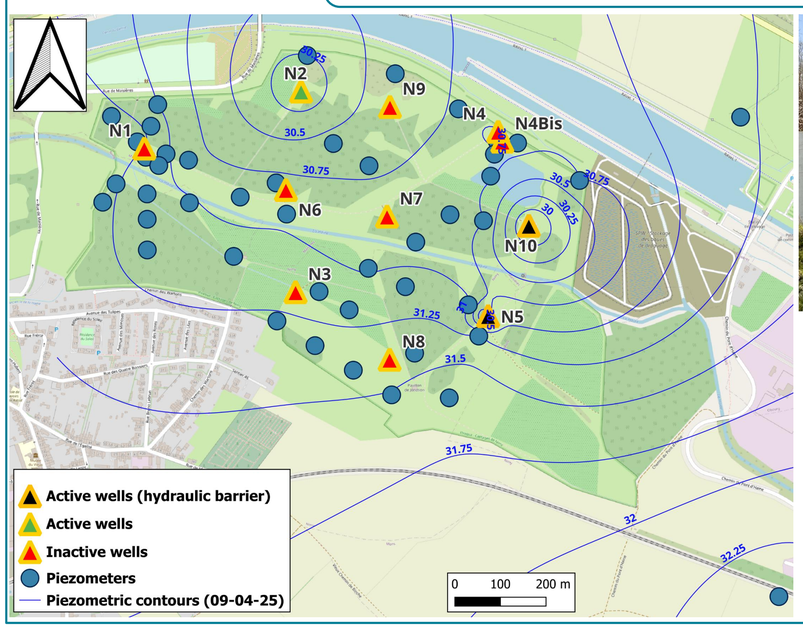
The pilot site in Nimy (Mons) was selected to characterize and investigate the origin and transport pathways of the contamination. The site includes 11 production wells reaching depths of up to 100 m, along with approximately 60 shallower piezometers that intercept the chalk aquifer. It supplies an average of 14 million m^3 of water per year. Key questions remain regarding the interactions between aquifer compartments, potential pollution sources, the influence of local watercourses, and preferential flow paths.

How

To address these questions, a comprehensive series of investigations is planned over the coming years, including the drilling of piezometric doublets, tracer tests, flow measurements, and various logging techniques. An initial sampling campaign was recently conducted on all piezometers at the site, and the first results are presented in this poster.



Sampling Campaign



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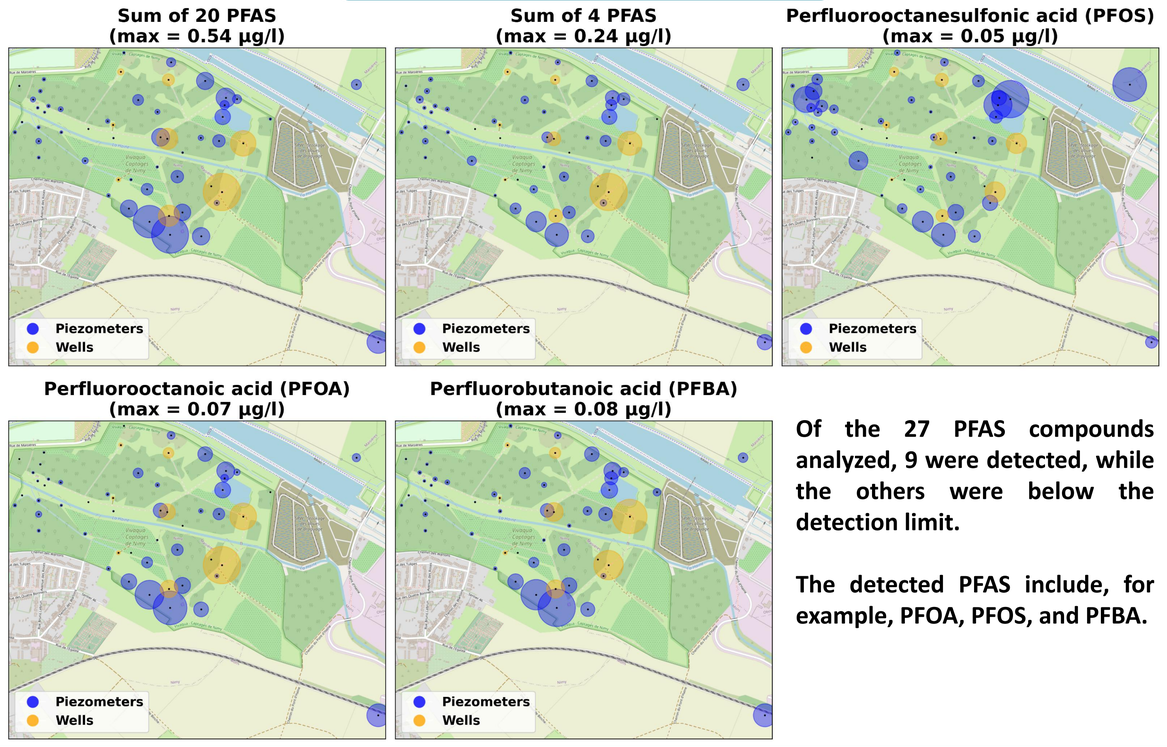
In March 2025, 46 piezometers were sampled.

A wide range of analyses was conducted, including PFAS analysis.

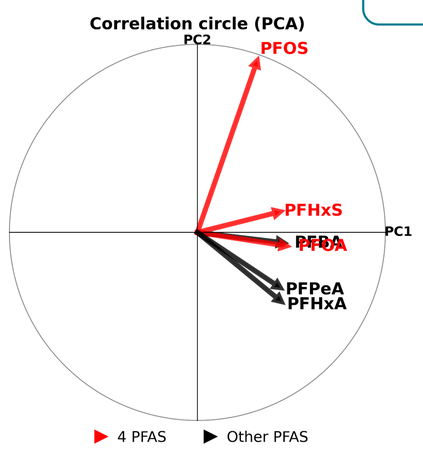
Mapping of PFAS

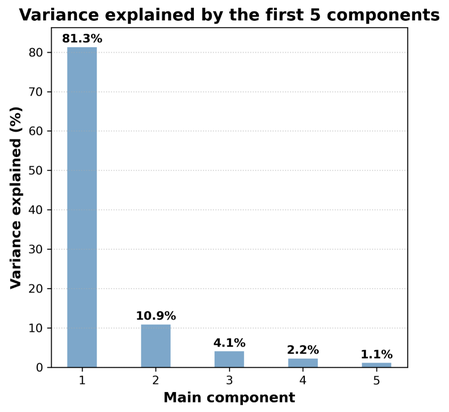


Of the 27 PFAS compounds analyzed, 9 were detected, while the others were below the detection limit.

The detected PFAS include, for example, PFOA, PFOS, and PFBA.

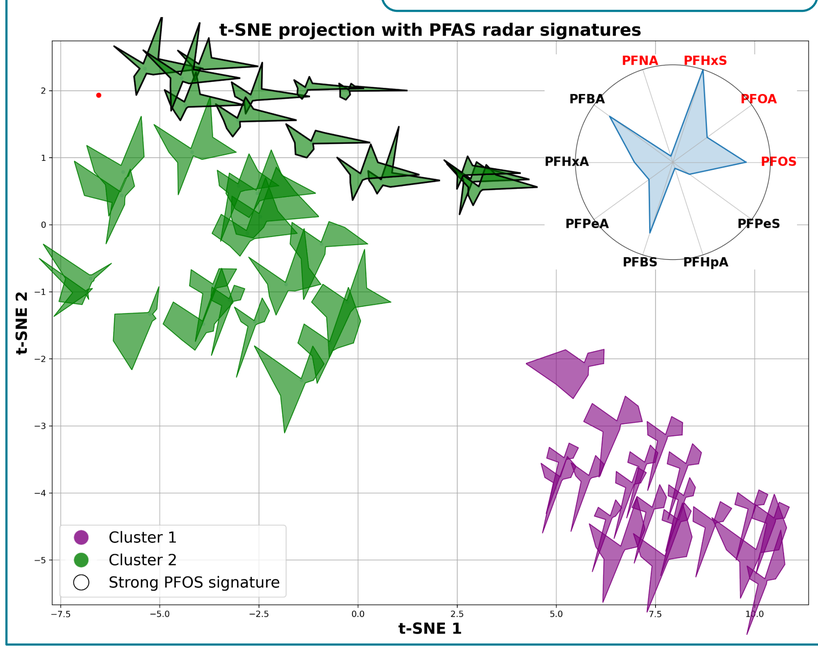
PCA





Principal Component Analysis (PCA) was used to reduce the number of variables and better visualize relationships between PFAS compounds.
Only six PFAS with a normal distribution were included in the analysis. The correlation circle shows that PFOS appears less correlated with the other compounds, suggesting a distinct behavior. This observation is consistent with its spatial distribution shown on the maps above.

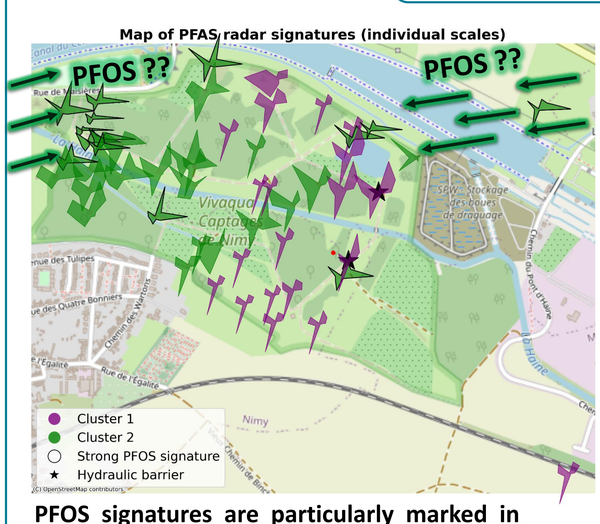
Radar & t-SNE



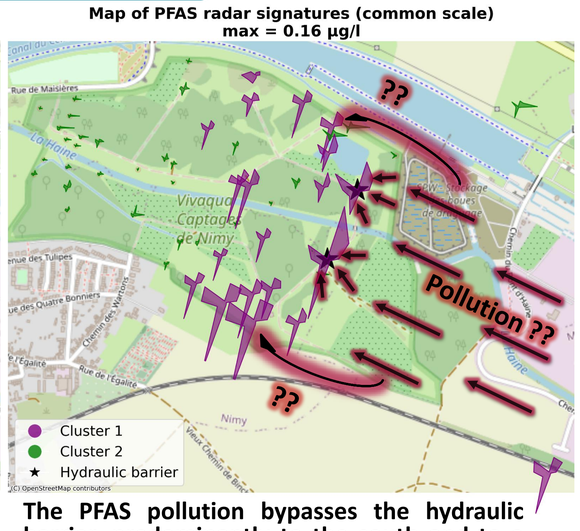
Following the PCA, t-SNE analysis was used to enhance the visualization of individuals showing similar PFAS profiles, based on their proximity in the PCA space.

This analysis revealed two distinct clusters: a purple group, representing individuals with the highest PFAS concentrations, and a green group, corresponding to those with lower concentrations. In addition, PFAS radar signatures were used to identify piezometers showing a distinct PFOS peak.

Interpretations



PFOS signatures are particularly marked in piezometers located in the north-west and north-east of the study area.



The PFAS pollution bypasses the hydraulic barrier, predominantly to the south and to a lesser extent to the north.

Perspectives

The following actions are planned to improve the understanding of PFAS dynamics at the site :

- **Analysis of additional hydrochemical parameters**
- **Vertical sampling of wells**
- **Drilling of new piezometers**
- **Characterization of flows**
- **Implementation of tracer tests**

PDF link

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