Making invisible dangers visible

High-precision measurement of PFAS

University of Stuttgart
Institute for Modelling Hydraulic and Environmental Systems

The VEGAS research platform (Research Facility for Subsurface Remediation) at the University of Stuttgart is the only facility of its kind throughout Germany. It is involved in the development, testing, and optimization of innovative remediation technologies for contaminations in soil and groundwater.

"The measuring solutions have made our everyday working lives significantly easier. The convenient handling and quick sensor replacement, in particular, ensure efficient and flexible use. Thanks to digital data acquisition and the smartphone app, we always have access to accurate measurement results that can be processed immediately."

Dr. Simon Kleinknecht,
Technical Director
University of Stuttgart - IWS/VEGAS

What exactly is in the everyday products we use?

PFAS ensure that products such as outdoor jackets and pizza boxes are water-repellent and grease-repellent. Their chemical stability is functionally useful, but it poses a significant risk to the environment and human health, as these substances do not readily degrade and can enter the soil and water bodies.

Challenge

PFAS (per- and polyfluoroalkyl substances) are extremely durable industrial chemicals that do not readily degrade in the environment due to their high stability. They accumulate in soil, water, and, to some extent, in the human body. They enter the soil via contaminated sites, industrial wastewater, or atmospheric deposition, and can then migrate from there into the groundwater. As a result, they pose a long-term risk to drinking water resources, ecosystems, and human health.

Accurate measurements across sites are necessary to better understand the behavior of these substances and to develop effective measures to control their spread or removal. This involves the continuous monitoring of key hydrochemical parameters—including pH, conductivity, and dissolved oxygen—which offer insights into the mobility, transport mechanisms, and transformation of PFAS.

The measuring task is very demanding: The instruments must function reliably in both controlled laboratory settings and real field environments, deliver precise measurements, and be mobile and flexible enough to adapt to different conditions. At the same time, consistent data collection is crucial to create a reliable basis for scientific analyses and regulatory assessments.

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Multiparameter handheld Liquiline Mobile CML18

Process

Accurate measurements are carried out both in the laboratory and in the field to gain a better understanding of the spread of persistent pollutants such as PFAS in soil and groundwater. For this purpose, mobile measuring instruments are used in conjunction with digital sensors to provide reliable measurements of key parameters such as pH value, conductivity, and dissolved oxygen.

In the **laboratory**, contaminated soil samples are placed in lysimeters, which are specialized experimental systems designed to simulate real soil conditions as accurately as possible. Rainwater is then artificially applied to observe how much water seeps through the soil and which pollutants are washed out in the process. The sensors continuously record the changes in the relevant parameters, providing accurate information on how mobile the pollutants are and how quickly they are released from the soil. These controlled conditions enable detailed analysis of pollutant behavior and place high demands on the measuring instruments: they must not only be precise and reliable, but also flexible and easy to replace so that they can be adapted to different sample conditions.

In the **field**, on the other hand, soil water samples are taken under real environmental conditions. Wells are used to extract groundwater from deeper soil layers, as well as suction lysimeters, which extract water directly from the soil. The same sensors are used here also to analyze the samples on site. The devices must be mobile, robust, and weatherproof, as they need to function reliably under changing conditions. The data captured digitally can be seamlessly processed and allow continuous monitoring of the relevant parameters. The objective of these measurements is to gain a better understanding of the behavior of PFAS in the soil and find out how to prevent them from spreading. Well-informed decisions and effective remediation strategies are only possible with precise, consistent, and cross-site monitoring of all relevant parameters.

Our solution

When used in conjunction with digital Memosens sensors, the Liquiline Mobile CML18 multiparameter handheld instrument offers a flexible and high-performance solution for precise environmental measurements both in the laboratory and directly in the field. The plug-and-play sensors can be replaced quickly without the need for tools, which means that various parameters such as pH value, conductivity or dissolved oxygen can be measured with one device – regardless of the location. Digital signal transmission via Memosens guarantees a high level of measurement accuracy, even in humid or demanding environmental conditions. Measured data can be managed, documented and processed efficiently in combination with Memobase Pro CZL81. This creates a consistent and reliable data pool, which provides the basis for a sound assessment of pollutant behavior and facilitates the development of effective environmental strategies.

"We are impressed by the robust design of the devices, which are perfectly suited to use in damp and demanding environments. Overall, we benefit from a reliable, precise, and user-friendly solution that significantly optimizes our processes."

Dr. Simon Kleinknecht, Technical Director
University of Stuttgart - IWS/VEGAS

Advantages at a glance

- Time savings thanks to easy handling and tool-free sensor replacement
- Enhanced data quality as a result of automatic storage and digital signal transmission
- Efficient digital documentation via Memobase Pro - reduces manual errors
- Cost reduction due to lower equipment requirements and minimized maintenance costs
- Faster and more accurate analysis of environmental parameters for well-informed decisions

Dr. Simon Kleinknecht, Technical Director of the Research Facility for Subsurface Remediation (VEGAS)

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