



Experimental development of a process for recovering perfluoroalkylated and polyfluoroalkylated substances (PFAS) in high concentrations from soils using aqueous foams

Job offer from the institut de physique du globe de Paris | CNRS UMR 7154

Researcher in	Post-doctoral researcher for process development for recovering perfluoroalkylated and polyfluoroalkylated substances (PFAS) in high concentrations from soils using aqueous foams
Duration	23 months
Affectation	Institut de physique du globe de Paris, 1, rue Jussieu, 75005 Paris, France (Hiring laboratory) Bureau de Recherches Géologiques et Minières (BRGM), 3, avenue Claude Guillemin, 45100 Orléans, France (Hosting laboratory)
Salary	2 720,42 € gross salary
Date of publication	December 30th, 2024
Starting date	As soon as possible
Location	Orléans

The institut de physique du globe de Paris

A world-renowned geosciences organisation, the IPGP is associated with the CNRS and an integrated institute of the Université Paris Cité. Bringing together more than 500 people, the IPGP studies the Earth and the planets from the core to the most superficial fluid envelopes, through observation, experimentation and modelling.

The research areas are structured through 4 main unifying themes: Interiors of the Earth and Planets, Natural Hazards, Earth System and Origins.

The IPGP is in charge of labelled observation services in volcanology, seismology, magnetism, gravimetry and erosion. And the IPGP's permanent observatories monitor the four active French overseas volcanoes in Guadeloupe, Martinique, Réunion Island and Mayotte.

The IPGP hosts powerful computing resources and state-of-the-art experimental and analytical facilities and benefits from first-class technical support. The IPGP provides its students with geosciences training that combine observation, quantitative analysis and modelling, and that reflects the quality, richness and thematic diversity of the research conducted by the IPGP teams.

Team Department (IPGP)

The Biogeochemistry at the Anthropocene of Elements and Emerging Contaminants (ACE) team of IPGP is focusing on the study of the biogeochemical cycles of trace elements (from alkalis to actinides) in the critical zone and more specifically their evolution during the Anthropocene. The transfer dynamics of elements in the critical zone play an important role in the evolution of land surfaces.

Research questions addressed by the team are:



- What is the chemical speciation for these elements (ions, complexes, colloids) ?
- What are the transport and transfer processes of metallic elements (ME) in natural compartments (soils, sediments, water, air) ?
- What is modification of the mobility and availability of metallic elements under the action of anthropic forcing ?
- What is the behavior and fate of emerging contaminants such as manufactured or accidental nanoparticles in the environment ?
- What are the processes allowing the valorization of Technological Critical Elements (TCE) in the context of the circular economy and urban metabolism, and whose biogeochemical cycles in the critical zone will be modified by their massive use for new technological applications ?

This team is also interested in the removal of organic micropollutants from contaminated sites and soils

The French Geological Survey (BRGM) - Host laboratory

BRGM is the reference public institution for the application of geosciences to the management of soil and subsurface resources and risks. It has two objectives:

- To understand geological phenomena and associated risks, to develop new methods and techniques, and to produce and disseminate high quality data,
- To develop and make available the tools needed to manage soil, subsurface and resources, prevent natural hazards and pollution, and respond to climate change.

BRGM carries out public policy support missions (expertise, monitoring and studies) for the State, local authorities, agencies and public institutions.

BRGM also provides expertise, research and development, technical and scientific assistance and training to private sector actors to help them with complex or challenging projects.

Within BRGM, the successful candidate will work in the Polluted Sites, Soils and Sediments unit. The unit is responsible for the development of multiscale methodological approaches, taking into account all sustainable development criteria, for the remediation and rehabilitation of sites (industrial, mining, waste dumps) and degraded territories (brownfields, mega-sites). This activity includes the development of safety and remediation techniques. These developments are carried out in situ and/or in halls and laboratories, with the mobilisation of metric to multimetric equipment, as well as analytical or process efficiency characterisation resources (e.g. geophysics).

Missions

Background:

There are few techniques for extracting PFAS (per- and polyfluoroalkylated substances) from soils. Among them, in situ washing involves injecting a solvent (typically water) into the soil, with or without additives (e.g. surfactants or alcohols), to desorb pollutants from the soil and then extracting the washing solution for treatment.

Injecting these liquids into heterogeneous porous media is tricky, as the less permeable zones will be less well cleaned due to hydrodynamic instabilities and preferential pathways. To achieve good injection homogeneity in heterogeneous media, surfactants or alcohols can be injected using non-Newtonian shear-thinning liquids, using approaches similar to those used for enhanced oil recovery. The viscosity of such fluids decreases with increasing shear rates. Injected liquids will be more viscous in permeable layers and less viscous in less permeable layers. This means they can theoretically sweep the entire porous medium more evenly. Aqueous foam can behave as a shear-thinning fluid and have the advantage of generating fewer fluids effluent than, e.g., polymers.



The postdoctoral research will focus on the development of non-Newtonian liquids, and in particular aqueous foams, to desorb PFAS from soils while generating as little effluent as possible.

Activities

The aim of the postdoctoral research is to develop a method for extracting PFAS from porous media using non-Newtonian liquids, mainly foams. The PFAS studied will be long-chain (more than 6 carbon atoms), short-chain (between 3 and 6 carbon atoms) and ultra short-chain (less than 3 carbon atoms). The postdoctoral research will focus mainly on laboratory experiments. Batch studies will focus on the adsorption and desorption of different PFAS with different soil matrices and water compositions. Different non-Newtonian liquid formulations will be characterized (interfacial tension, viscosity, foamability, etc.). 1D column tests with different porous media will be used to validate the formulations developed (extraction yields, flow/pressure ratio, type of injection). These tests will be validated in 2D tanks. Monitoring will be carried out using TDR probes and image interpretation techniques.

Expected Skills

> Specific training

- Ability to use experimental set-up such as 1D column tests and 2D tanks and use TDR probes and image interpretation techniques
- Experience on process application for the removal of organic micropollutants in complex matrices

> Computer tools

- Office package and perform statistical analyses

> Professional qualities

- Be able to solve problems
- Have the ability to work independently (in autonomy) as well as interact well in a research group
- Demonstrated ability to work effectively in a multi-disciplinary team
- A high proficiency in written and spoken English.

Obligations and risks

> Work schedules: in accordance with BRGM rules (from 8:27 till 17:00)

> Work attendance: in accordance with BRGM rules (from 35 h 20 to 38 h 50 per week)

> Professional trips

- Visits to the polluted site (unlikely)

Training and experience required

> Minimum of 5 years experience including PhD study period

> Education level or diploma : The candidate must hold a PhD in fluid mechanics in porous media, hydrogeology or soil remediation. Previous knowledge in the formulation of non-Newtonian liquids, and in particular foams, will be highly appreciated.

How to apply

> CV and cover letter



> Deadlines for applications : **until the position has been filled**

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