

## JOB PROFILE

Post-Doctoral Researcher combining geochemistry, geophysics or hydrogeology

## PROJECT TITLE:

# IMPACT OF GROUND WATER TABLE VARIATIONS INDUCED BY CLIMATIC CHANGES ON PETROLEUM HYDROCARBONS REMOBILIZATION (LNAPL)

## DESCRIPTION

Petroleum hydrocarbons represent the most important contamination source of soils (37.22%) (MTES, 2018). These light non-aqueous phase liquid (LNAPL) contaminants infiltrate through the unsaturated zone of the soil and migrate to the top of the aquifer before accumulating above it, forming a pure phase. Under the action of capillary forces, part of the LNAPL remains trapped during its migration. Sites contaminated with LNAPL are complex to clean up because these areas are subject to significant bio / geochemical evolution (type of metabolism, redox conditions, ...) and have a large variation in NAPL saturation level depending on the location of the zone (source or plume).

In the case of a "stagnant" water table, volatilization and dissolution studies of LNAPL-type organic pollutants suggest that volatilization is limited by slow diffusion and negligible vertical dispersion in the aqueous phase. However, the seasonal variability generates vertical spreading and mixing of the LNAPL at the level of the capillary fringe. It increases the exchange surfaces between the LNAPL and the gaseous / liquid phases according to the cycles of descent and rise of the piezometric level and, *de facto*, favors the release of pollutants (dissolved and gaseous phases). This mechanism of organic pollutants release is correlated with the variations of the piezometric level. These variations are expected to increase in the coming decades as a result (i) of changes in water table behavior associated with climate change (decrease in precipitation volume and higher variability of water intensity) and (ii) of the increase in use of groundwater resources. This evolution will have an impact on the groundwater recharge and will lead to more pronounced water-table variations.

The overall objective of this research project is (i) to better understand the impact of groundwater level changes on hydrocarbon release mechanisms in a climate change context (extreme events), (ii) to evaluate and to compare the capacity of different methods for monitoring / characterizing the LNAPL saturation distribution in soils (piezometric vs. geophysical measurements and *in situ* probes).

This work is based on a multi-scale approach (laboratory column- and lysimeter-scale) with at the heart, an original experimental device coupling indirect geophysical measurements and *in situ* physico-chemical measurements (via probes and porous candles) to assess the nature and quantity of LNAPL release (pure, dissolved and gaseous phases). Numerical simulations of multiphase flow and contaminant transport will be also carried out for comparison with experimental data and for identifying the key mechanisms of NAPL release.

## OPEN POSITION

## SELECTION CRITERIA

The applicant must hold a PhD degree in geochemistry, geophysics or hydrogeology with, ideally, a strong track record on:

- *Scientific skills*: Knowledge in organic geochemistry applied to polluted soils, knowledge in hydrogeology and geophysics. Expertise in flow and transport processes in porous media and experience in using commercial simulation software such as Comsol Multiphysics will be highly appreciated. .

- *Technical skills*: accustomed to using field monitoring equipment (piezometers) and laboratory columns.

- *Communication skills*: Very good ability to write and transcribe results in English, autonomy in writing scientific articles, excellent written and oral communication skills, good aptitude and motivation for teamwork.

## TERMS AND TENURE

This full time 12-months position with a possible second-year extension will be based at both **GeoRessources** and **LIEC** laboratories of the **Université de Lorraine in Nancy, France**. GeoRessources is a multi-disciplinary laboratory devoted to the study of geological resources, their exploration and exploitation, as well as their impact on society and the environment. Research objectives of the LIEC are to understand the functioning of continental environments strongly impacted by human activities in order to contribute to their rehabilitation.

This Post-Doctoral project is within the framework of the work of the GISFI (<http://gisfi.univ-lorraine.fr>) and relying on the equipment of the experimental station of Homécourt (lysimeter devices). As a matter of fact, the Post-Doctoral Researcher will have to move frequently on the experimental station (80 km from Nancy) and will need a driver's license.

The target start date for the position is March 2020, with some flexibility on the exact start date.

The gross salary, depending on experience, will be between 2,130 and 2,650 euros/month including social benefits and health care. Travel expenses for conference participations are secured

The successful applicant will be directly supervised by Dr. Pierre Faure (LIEC) and Dr Fabrice Golfier (GeoRessources) in collaboration with Stéfán Colombano, Hossein Davarzani and Jacques Deparis (BRGM) and will collaborate with the experimental station staff of the GISFI.

## HOW TO APPLY

Applicants are requested to submit the following materials:

- A cover letter applying for the position
- Full CV and list of publications
- Two selected publications
- The names and contact information of two referees

Deadline for application is **15<sup>th</sup> January 2020**. Applicants will be interviewed by an ad hoc Commission.

Applications are only accepted through email.

All documents must be sent to [pierre.faure@univ-lorraine.fr](mailto:pierre.faure@univ-lorraine.fr), [fabrice.golfier@univ-lorraine.fr](mailto:fabrice.golfier@univ-lorraine.fr) and [S.Colombano@brgm.fr](mailto:S.Colombano@brgm.fr)