

Post-doctoral position

Paris, France - 18 month

Scientific project title : Characterization and quantification of lead runoff from lead roofs used in historical monuments

Fields of specialization : Environmental chemistry, materials sciences

Keywords : Emissions, Lead, Lead roofing, runoff, Concentrations and fluxes, Test benches, *in situ* sampling.

Institutional context :

This postdoctoral fellowship is part of a research agreement shared between Ecole des Ponts ParisTech/Leesu and RNDP, the company in charge of the renovation of Notre-Dame Cathedral (Notre-Dame de Paris) .

It is a project associated with the urban hydrology observatory OPUR initiated and led by LEESU since 1994. OPUR develops multidisciplinary research on the knowledge and management of water and contaminant flows in urban areas.

Scientific issues, objectives and methodology :

Lead is widely used in historical buildings for the realization of complete roofs, or waterproofing and drainage elements. However, this use raises the question of the lead contamination of water running off these roofs during wet weather, and of their potential impact on the environment, and even their sanitary impact.

Initial studies on lead runoff show very high lead concentrations in runoff (Schulze-Rettmer 1995, Matthes et al. 2002, Faller and Reiss 2005, Bittner 2006). The PhD thesis of Pauline Robert (2009) provided first elements on the concentrations and fluxes emitted by lead waterproofing elements in the atmospheric context of the Parisian agglomeration. The knowledge on lead runoff is currently very partial, often acquired on small samples of material, in atmospheric and rainfall conditions different from the Paris region and not covering the different types of coverings used on historical monuments (lead cast on sand in particular).

In order to provide a tool for predicting the behavior of a sand-cast lead roofing, at Notre-Dame Cathedral but also for other historical monuments, as well as a tool for planning the necessary monitoring and management actions on such a structure, it is important to deepen the research work already available, with the objective of better understanding the lead runoff potential of these roofings.

The proposed postdoctoral work aims to characterize and quantify lead runoff from *in situ* tests on 6 roof sections of the Notre Dame Cathedral and on 17 test benches allowing the testing of lead of different ages (new, less than 5 years old and historical) and nature (sand cast and laminated lead), exposed with two slopes (5° and 55°) and two different orientations. These experimental devices will be monitored for a period of 12 months. The work also integrates a contextualization of these emissions (to situate the flows and concentrations in relation to other urban sources, and in relation to regulatory or environmental thresholds)

and a prospective dimension on the solutions which would allow to limit the release or the impacts of the release of lead in the runoff water in the case of the renovation of Notre-Dame Cathedral.

On the methodological level, the experimental protocol on benches set up in 2009 by Robert-Sainte for the quantification of total lead on a monthly scale will be applied, and completed by an approach of in situ sampling on the cathedral itself and by a campaign of event-driven sampling aiming at evaluating the distribution of lead between the dissolved and particulate phases.

The program should thus provide data on sand-cast and laminated lead of different ages. The analysis of the results provided will make it possible to compare the release potentials of metallic elements between new and old materials and also to verify whether the emission of metallic fluxes evolves according to seasonal meteorological conditions. The program will therefore provide new data on lead runoff from lead roofing elements of different nature, age, exposure and corrosion.

Profile sought : We are looking for a PhD in environmental chemistry or materials sciences (or more generally in environmental science and technology) with experience in the field of stormwater pollution. Skills and interest in experimental monitoring and data analysis are desired. Ability to work in a team on a multidisciplinary subject (hydrology, chemistry, statistics, data analysis) will be appreciated. Fluency in English will be required.

Administrative arrangements : 18-month fixed-term contract (CDD) (start up as soon as possible)

Location : the post-doctoral fellow will be mainly based École des Ponts ParisTech (<http://www.enpc.fr/en>), in Paris conurbation, within Leesu research laboratory <https://www.leesu.fr/>.

Risks: Interventions in lead areas: training will be provided beforehand to work in this environment.

Salary : According experience and salary scale at ENPC

How to apply ?

Send all the following documents in one PDF file to marie-christine.gromaire@enpc.fr , bernard.de-gouvello@enpc.fr and ghassan.chebbo@enpc.fr :

1. Cover letter stating your experience in relation to the subject of the postdoc
2. Curriculum vitae including a list of your scientific publications
3. Names and addresses of two referees for professional references