

SUBJECT TITLE: Evaluation of the oxidative potential of particulate matter as a relevant health metric

SCIENTIFIC DEPARTMENT (LABORATORY'S NAME): [IGE](#) and [IAB](#) (joint appointment), Grenoble, France

DOCTORAL SCHOOL: TUE

SUPERVISORS' NAME: *Gaëlle Uzu (CR, IRD), Rémy Slama (DR, Inserm)*

SUBJECT DESCRIPTION:

This interdisciplinary PhD is conducted in the context of a collaboration between scientists with expertise in atmospheric geochemistry (Chianti, IGE, Grenoble) and environmental epidemiology (Slama team, IAB, Grenoble). It will be part of the recently funded Mobil'Air project which aims to identify specific measures to significantly reduce atmospheric pollution in cities and its impacts.

[Mobil'Air project](#) has the following key aims:

- 1) To better characterize a population's exposure to pollution.
- 2) To improve our understanding of the factors determining mobility behavior.
- 3) To assist public-sector decision-making.

Mobil'Air will develop an integrated approach in the urban area of Grenoble, which is a relevant pilot area. Mobil'Air will seek to develop methods and instruments which can be copied in other cities in France and in other countries. Working in partnership with local government, Mobil'Air project will combine modelling, environmental measurements, recurrent surveys of local residents, cohorts with their biobanks, study of impacts on public health, direct intervention on several hundred house-holds, by a team of researchers.

In this general framework, the specific work of the PhD will be included in the previous first aim of the assessment of the population's exposure to air pollution. All the work will be conducted at the interface of both teams.

State of the art and context of the PhD program.

Epidemiological studies suggest that the larger part of chronic effects of air pollution is likely to stem from PM, although separating the effects of PM from correlated pollutants is challenging. One key parameter that drives the toxicity of PM is their carrying or inducing reactive oxygen species (ROS), which are able to disrupt its redox balance. Both acellular and cellular methods were developed to quantify the PM capacity for in vivo generation of ROS: this new toxicologic metric is defined as the OP of aerosols. OP integrates particles size and surface properties together with chemical composition of PM, yielding a unique metric likely to be more representative of their potential interactions with specific targets in the human body. PM OP is a promising marker to understand their health impact and may be a better predictor of PM toxicity than PM mass concentration or even partial chemical composition. Several assays are currently developed to assess the OP of PM. No consensus has emerged towards a standard test. Among these tests, acellular assays have the advantage of being fast, cheap, and non-invasive compared to cellular tests, and are therefore promising in terms of their use in the large scale of epidemiological studies. This is a challenging and promising area of the research linking air quality, environmental chemistry, and health.

Scientifics goals of the PhD project:

- 1) *To link oxidative potential and chemical composition of PM in Grenoble area*

A detailed chemical characterization of PM and markers indicative of the sources considered by policy measures, will need to be confronted with the oxidative potential of these PM, using several complementary assays (DTT, AA...). Measurements will include (i) long term measurements at two sites in areas impacted by the plans aiming at improving air quality and one site outside such areas; (ii) a multi-sites study to map PM concentrations and OP from

indoor environments from SEPAGES cohort, to be compared to outdoor measurements; The PhD will evaluate the environmental effectiveness of the emissions' reduction plans (using traffic emission and residential biomass burning markers) and to evaluate variations in OP across the city, outdoors and indoor.

2) To test the relevance of PM oxidative potential for human health using a cohort with personal PM sampling

In the context of SEPAGES mother-child cohort (484 families), pregnant women have carried for eight days on two occasions in early and late pregnancy a personal PM sampler; air samplers are also being used in children around six weeks and filters are stored. The personal oxidative potential will need to be evaluated on these filters. The central work will be to evaluate the association between OP and the health of the children assessed at birth and up to three years of age adjusting for the relevant confounder. Health outcomes include children's respiratory and neurodevelopmental health. In addition, associations with epigenetic marks (genome-wide DNA methylation and transcriptomic, already funded) could be characterized, using appropriate data reduction and variable selection models.

ELIGIBILITY CRITERIA

Applicants:

- must hold a Master's degree (or be about to earn one) or have a university degree equivalent to a European Master's (5-year duration), and have knowledge in one of the area of the PhD; some practical knowledge of biostatistics/data base handling would be a strong asset.

Applicants will have to send an application letter in English and attach:

- Their last diploma
- Their CV
- A short presentation of their scientific project (2 to 3 pages max)
- Letters of recommendation are welcome.

Address to send their application: jean-luc.jaffrezo@univ-grenoble-alpes.fr, gaelle.uzu@univ-grenoble-alpes.fr and remy.slama@inserm.fr

TYPE of CONTRACT: temporary-3 years of doctoral contract

JOB STATUS: Full time

HOURS PER WEEK: 35

OFFER STARTING DATE: April 2018

