

# **Title: Deterministic and stochastic modeling approaches for risk assessment at regional scale based on an integrated use of different environmental media**

**Tutor: Stefano Albanese**

## **Research program**

The project proposes a multidisciplinary research aiming at developing an appropriate framework of methods to integrate geochemical data proceeding from previous and ongoing environmental prospecting activities with information on lifelong human exposure to environmental stimuli (human exposome). Together with the genetic component, the exposome contributes to the development of chronic diseases, so its understanding is important for the definition of new protection strategies.

The goal of the proposed project will be a) the analysis of the potential relationships existing among environmental exposure to geological and technogenic materials and health of population and b) the development of new methods to approach human health risk through the use of geospatial and geostatistical tools in a stochastic (probabilistic) perspective, where possible.

Basically, the project will develop and test a new operative method consisting in the integration of most of the well-known parameters influencing human exposure to toxic substances in the environment (taken as a statistical distributions not as a deterministic values) and geochemical data reporting the distribution of inorganic and organic pollutants in geogenic, geological-related and biological media such as stream waters and sediments, soil, air, crops, etc.. It will be developed through the management of the data by means of their geographical nature using GIS; this will radically change the traditional flow in risk assessment often tested only for site-specific purposes without any need in developing prioritizing criteria for wide urban or regional areas characterized by the presence of multiple environmental hotspots.

Given the peculiar nature of geochemical data compositional data (CoDa) analysis will be used as a tool to enhance their performance and attempts will be made to generate new reliable indices to depict the degree of contamination of the environment through a comprehensive use of information proceeding from different media and sources.

Specific attention will be specifically given to the exposure to pollutant in air and water including emerging contaminants.

## **Proposal for a PhD position**

The PhD candidate will be in charge of organizing and consolidating the existing asset of the geochemical data produced by the research group and he will prepare all the data to generate a sound base for the development of a potential operative model to be applied and verified during the PhD course.

As a first step, he will have to explore the actual availability of tool and solution for the management of environmental risk at non site-specific scale providing a review which will be the basis to research activity.

During this phase the candidate will be required to study advanced statistical and geo-statistical methods, to be used as a necessary tool to generate explorative data analysis and to develop risk assessment procedure based on probabilistic approaches (e.g.: Monte Carlo method).

Big databases proceeding from regional and continental-wide prospecting activities available to prof. Albanese will be provided to develop new methods and test their reliability.

The student will visit each foreign institution, possibly, for a period not shorter than three months to collaborate with local researchers in order to develop specific aspects of the research plan.