# Title

# Definition of the conceptual model, assessment of environmental risks and analysis of the best available techniques at eligible costs (BATNEEC) for the environmental recovery of a brownfield characterized by a multi-source contamination

# Tutor: Stefano Albanese

# Research Proposal

The surface environment is the point of contact between humans and ecosystems. Over the centuries, the historical and prehistoric presence of man on the surface has generated significant changes in the compositional characteristics of the environmental matrices involved, often endangering the survival of various sensitive living species and the balance of ecosystems.

Indeed, today, the main points of anthropic pressure on the environment are represented by those production sites (industrial) that process raw materials with the help of means and chemicals of natural origin and/or particularly toxic synthesis.

The severity of the impact exerted by an industrial site on the environment is often a function of the operators' lack of attention to the environment (especially in the past), the inadequacy and/or obsolescence of the means and production techniques used and the complexity of the processing cycles due to the different stages of which it is made up may present a greater "predisposition" to generate environmental criticalities.

In the past, in a context of less sensitivity of the institutions to issues related to environmental protection, some disused industrial sites have remained uncontrolled, and the raw materials not used as well as the potentially toxic process residues present in the site at the time of discharge have remained uningested and have generated posthumous phenomena of significant contamination to the superficial and deep environmental matrices. In some cases, process residues have such volumes and characteristics that make their environmental management particularly complicated and expensive for those who are called upon to manage them: especially in the past, in the absence of defined regulatory indications, they have often been stored in a subaerial environment or buried within the grounds of industrial sites, trusting in the purifying potential of the soil.

In the framework of this environmental issue, the proposed PhD project has the following primary objectives:

* The historical reconstruction of the industrial development of a dismissed site historically engaged in tanning transformation processes.
* The development of the conceptual model of the site with the application of a multi-source contamination system
* The evaluation of the potential release of potentially toxic substances to the environmental context aimed at a probabilistic risk estimate.
* The specific analysis of the characteristics of waste materials (derived from the production process) stored in the subaerial or underground environments of the site to identify the best techniques available at eligible costs (BATNEEC) to reduce their environmental impact.

It will be possible to collaborate on other topics associated with the primary research direction of the doctoral topic.

A six-month stay abroad at a research centre or a university institute is planned to expand some specific knowledge on topics pertaining to the project.

# Research program:

**Plan of activities (guideline)**

*I° Year*

* Collecting and optimizing available data concerning the site to create an information base that can be used for the project's development.
* Acquiring specific skills for to develop an advanced Site Conceptual Model and an environmental and health risk assessment using both a deterministic and a stochastic approach.
* Acquiring specific skills in univariate and multivariate methods of statistical data analysis
* Participating in laboratory tests at the project partner company for integration and improvement of knowledge of the site-specific characteristics.
* Completing a critical review of literature material on stabilization and reuse techniques of industrial waste materials.
* Collaborating in research and data processing activities already in place with inclusion in the workflow related to the development and drafting of scientific work.

*II° Year*

* Completing a 6-month experience at a foreign research or academic institution
* Participating in laboratory and field tests on contaminated materials at the project partner company site and
* Drafting and submission of scientific work summarizing the results obtained during the foreign experience and downstream of the preparatory work carried out.

*III° year*

* Elaborating a definitive environmental risk estimation model compatible with the study site.
* Summarizing the results from literature analysis and laboratory tests with the purpose of evaluating the best available techniques at eligible costs (BATNEEC) for the environmental restoration of the site.
* Drafting and submission of scientific work(s) including the results obtained.
* Preparation and submission of the thesis work