Research Projects

Contributed by Administrator

The Joint Programme of Work is structured around 8 key areas of study within and across which individual research projects will be undertaken by the researchers.

1.Â Chemical speciation and inorganic processes controlling mobility in key fieldÂ sites
Chemical speciation in waters and soils of arsenic and selenium will be determined in range of field sites in representative regions, and for which the geology, hydrogeology and anthropogenic inputs are well understood through past work. Sampling strategies will be developed followingÂ a review of available maps and data in the study areas and recompilation of soil, geology, climate, land use, culture type, topography, and other data for each one of the study areas.

2.Â Microbial processes controlling geogenic chemical mobility
The microbial communities present in sediment and water samples will be profiled using cultivation-independent molecular techniques, and their structure correlated with the biogeo-chemical conditions in situ.

3.Â Speciation and biochemical processes controlling chemical uptake into theÂ food chain
Key compartments of the soil-water-plant system focusing on parameters controlling arsenic behaviour in the rhizosphere of selected food crops will be investigated. This will include (a) the assessment of bacterial control on arsenic cycling including identifying bacteria by a molecular approach based on the sequence analysis of the rRNA genes; (b) assessment of the control of redox cycling and phosphate supply to arsenic transfer; (c) the capacity of iron plaques in the rhizosphere to fix arsenic; and (d) determination of arsenic speciation in solid, aqueous and colloidal ‘phases’.4.Â Chemical speciation and biochemical processes controlling uptake in humans
Urine, hair and nail samples will be systematically collected from individuals from different regional groups, selected on the basis of representatively distinctive geology, arsenic and selenium content in drinking water, dietary intake and genetic background. A total diet study will be carried out to explore how the content of arsenic and selenium in food and drinking water correlates with the pattern of arsenic excretion for the different genetic groups residing in different regions of Europe.

5.Â Inorganic remediation technologies
Traditional ZVI and nano-scale ZVI will be combined to determine its effectiveness in stabilizing arsenic contaminated soils and identify the arsenic removal mechanisms. This will be done at various scales using a combination of laboratory columns and field-based pilot plants and will be applicable for the treatment of groundwater not only from geogenic geothermal sources but also from industrial and mining contamination. A variety of alternative inorganic remediation methods will also be studied.

6.Â Biological remediation technologiesÂ
The aim will be to formulate robust "biostimulation" techniques that enhance natural biogeochemical processes to limit the environmental mobility of key target metals. This will be tested under a range of process environments relevant to both in situ and ex situ remediation. A range of novel biotechnological processes will be assessed for both in situ and ex situ remediation applications.Â

7.Â Speciation techniques for nanoscale characterisation
Speciation technique development will focus on (i) developing mild separation methods such as gel electrophoresis (GE) or size exclusion chromatography (SEC); and (ii) building upon an existing analytical system at Abderdeen where these separation techniques are coupled toICP-MS, which serves as an element-specific detector; GE is linked using laser ablation, while SEC is coupled directly.

8.Â Environmental and human impact assessments
A review of environmental and human health impact assessments of geogenic elements in groundwaters and soils in the EU will be undertaken, utilising existing databases and data generated by the project and EU wide studies of soil types and distributions (e.g. MOSES). The relationship between groundwater policy and groundwater management institutions will be researched. Groundwater Policy Systems and Science/Policy Interactions will be investigated through (i) institutional analysis of science/policy interactions in the field of groundwater policy at EU member state-level using analytical frameworks able to incorporate the multi-level governance system of the EU; and (ii) comparison of institutional models for science/policy integration outside of the EU.