Science for Environment Policy
DG Environment News Alert Service
European Commission

23 June 2011

More research needed into contaminated soil and water treatment

A new review from Romanian researchers has summarised current and emerging methods for cleaning up contaminated land and water. It highlights the need for more consistent testing, reporting and evaluation of different remediation techniques.

Dealing with contaminated soil and groundwater is an issue of high environmental importance. According to the European Environment Agency (EEA), there are about 250,000 sites that require clean up actions in its member states. There are a range of pollutants that require treatment. Metals and mineral oil are suspected to be the most frequent soil contaminants, whereas mineral oil and chlorinated hydrocarbons are most often found in groundwater. Other contaminants include persistent organic compounds (POPs) and polychlorobiphenyls (PCBs). There are a variety of techniques to treat contamination, ranging from simple biological processes to advanced engineering technologies.

Several biological processes are used to remove metal contaminants, which involve exploiting biological organisms. For example, phytoremediation uses living plants to extract and accumulate contaminants from the ground. The plants can then be harvested or, in some cases, the contaminant is released from the plant into the air. Phytoremediation is low cost and some of the extracted metals can be recycled. It is also more acceptable than other methods as it involves no noisy and expensive equipment. However, it is more time consuming and not effective for sites with high levels of contamination.

The use of chemical reactions, such as oxidation, reduction and neutralisation, is another method of decontamination. This involves adding chemical agents to the soil to cause reactions that destroy or neutralise the contaminants. An alternative is electrokinesis, where a low electrical current is run through the contaminated soil to initiate chemical reactions.

The removal of POPs can also use biological processes, such as biosparging or bioventing. Air or oxygen is delivered to soils to help naturally occurring bacteria degrade the contaminants. Nanotechnology is an emerging area for decontamination. With their small size and large surface area, nanoparticles have great potential to change contaminants or promote biological reactions.

Establishing a remediation strategy requires a number of steps: producing a map or model of the contaminated site; establishing the contaminant concentration; listing the site characteristics, for example, its geology and hydrology; and determining the exposure pathways and sensitive groups on the site. Once a strategy is developed, it needs to be assessed economically, usually with a cost-benefit analysis. The benefits derive from avoiding environmental damage, such as increased human health and property value, whilst the costs are the economic costs of the process and also the costs in terms of the contribution to greenhouse gas emissions and the possible contamination of another medium, e.g. spreading from soil into water. All this must be placed in the policy framework at a national and regional level.

The review suggests that for successful treatment of contamination, the best solution may be a ‘treatment train’ that applies several remediation techniques and technologies. In order to choose a remediation strategy, consistent testing, reporting and evaluating procedures are needed, as well as more research and development to fully implement emerging technologies.

Source: Caliman, F.A., Robu, B.M., Smaranda, C. *et al.* (2011) Soil and groundwater cleanup: benefits and limits of emerging technologies. *Clean Technologies and Environmental Policy.* 13(2): 241-268.

Contact: mgav@ch.tuiasi.ro

Theme(s): Soil, Water