INTERSTATE TEHCNOLOGY & REGULATORY COUNCIL

Soil Washing and the Emerging Technologies of Phytoremediation, Electrokinetics, In-situ Stabilization/Inplace Inactivation (MIS-6)

EXECUTIVE SUMMARY

The Interstate Technology Regulatory Cooperation (ITRC) Work Group Metals in Soils Team published a series of technical documents in 1997. The two documents covering soil washing were, **Technical and Regulatory Guidelines for Soil Washing,** and **Fixed Facilities for Soil Washing A Regulatory Analysis.** Three documents on Emerging Technologies for the Remediation of Metals in Soils were published; **Phytoremediation, Electrokinetics**, and **In-Situ Stabilization/ Inplace Inactivation.** This report provides the 1998 updates for the five ITRC Metals in Soils Team documents published in 1997.

The *Technical and Regulatory Guidelines for Soil Washing* document was prepared for the regulators, vendors, site managers, and other interested groups. This document was designed to reduce the time required for reviews of permit applications, site investigations and remediation plans, allowing full-scale deployment of soil washing. The critical step in determining if soil washing is applicable is site characterization. If the soil at the site contains a large portion of sand (50-70%), soil washing may be cost competitive.

This report provides current updates of the ongoing projects using soil washing (Doe Run, Missouri, Astabula, Ohio, and Mt. Hope, New Jersey). There has been some progress in deploying new or upgraded soil washing techniques in the past year. The *Cost and Performance Report for Chemical Extraction for Uranium Contaminated Soil* for the Ashtabula site was published by DOE in July 1998. Discussions between the ITRC and California soil washing vendors illustrate how regulatory guidelines can affect the utilization of a technology.

Department of Energy facilities should have an interest in future uses of soil washing technology. The technology holds promise as one of the processes to remediate sites contaminated with radionuclides and/or organic chemicals. Soil washing continues to move at a steady pace in the remediation arena. Soil washing is a viable technology and is cost effective when site conditions are favorable. Data on site preparation, system design, setup cost, system operation and monitoring costs, waste handling, life cycle costs and system demobilization have been developed for many projects.

Phytoremediation is the term applied to biological; chemical and physical processes influenced by plants that aid in the cleanup of contaminated substances. Last year, the team prepared a status report on the phytoremediation of metals in soil. The team also identified both stakeholders and regulatory issues associated with the application of this technology. Phytoremediation is being applied at approximately 40 different sites within the USA to cleanup both soil and groundwater contaminated with metals, radionuclides, petroleum and organic chemicals. Phytoremediation involves a variety of biological mechanisms including direct uptake, release of exudates and metabolites and stimulation of the root-soil environment to enhance bacterial and fungal degradative processes.

Data on site preparation, system design, setup costs, system operation and monitoring costs, waste
handling, life cycle costs and system demobilization will be developed from the projects currently underway. ITRC may expand their activities on phytoremediation to other contaminants (e.g., organics) in soil and groundwater. State project managers need to become more familiar with the
requirements of phytoremediation as a technology.

IRTC=s Metals In Soils Team also prepared a technology status report on *Electrokinetics* for the *in situ* removal of heavy metals and radionuclides from contaminated soil. The process involves placing a series of electrodes (anodes and cathodes) in the soil. The application of a low voltage direct current creates a voltage gradient in a porous medium. The voltage gradient leads to transport of the contamination ions toward one of the electrodes. The report evaluated the status of the technology. Electrokinetic remediation has been used for a number of bench and pilot-scale tests. There have been problems with the premature precipitation of metal species close to the cathode. A field scale operation of this technology is currently underway at Point Mugu, California. There are studies underway using this technology for non-metal contaminants (organics) such as chlorinated solvents. The Lasagna demonstration in Paducah, Kentucky is testing the use of the technology on organic chemicals.

Electrokinetics is an emerging technology and the efficiency of the process must be evaluated. The cost effectiveness of this technology compared with other remediation technologies must be determined. Data on site preparation, system design, setup costs, system operation and monitoring costs, waste handling, life cycle costs and system demobilization needs to be developed from the projects currently underway. State project managers and other technology users will become more familiar with the requirements of electrokinetics as the technology matures. The ITRC may review the status of this technology once the above data are available.

In Situ stabilization/inplace inactivation is an emerging technology for site stabilization. This technique uses the application of soil amendments to alter the soil contaminant chemistry. Altering the soil chemistry makes the contaminants less soluble, less mobile, and less bioavailable. Inplace inactivation does not affect the total contaminant concentration, but reduces the risk of harm to target organisms (humans, animals, etc.) by reducing biological activity. The technology is being demonstrated/tested for a number of bench and pilot-scale studies around the world. More study is needed on this technology to determine the bioavailability of contaminates after the soil amendments have been applied. The USEPA has created the In-Place Inactivation and Natural Ecological Restoration Technologies (IINERT) Team to study and encourage the development of this technology. One of the sites the IINERT team is studying is the Joplin, Missouri site that is contaminated with lead.

In-Situ Stabilization is an emerging technology that merits continued study. The cost effectiveness of this technology compared with other remediation technologies must be determined. Data on site preparation, system design, setup costs and system operations are not yet available. The life cycle costs, requirements for reapplication of soil amendments and

determination of bioavailability of the contaminants are of great interest to the ITRC, regulators and the public. The ITRC may review the status of this technology once the above data are available.