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BUILDING A SCIENTIFIC FOUNDATION FOR SOUND ENVIRONMENTAL DECISIONS

LAND RESEARCH PROGRAM

IN SITU TREATMENT TECHNOLOGIES REDUCE SITE CLEANUP COSTS

Issue:

Groundwater treatment employs many different technologies. Conventional *ex situ* (removed from source) treatment methods, such as pump and treat, can have substantial operation and maintenance costs and may not achieve cleanup objectives within reasonable time frames, if at all. As an alternative, *in situ* (at source) processes treat soils and groundwater in place (without removal) with physical/chemical or biological treatment technologies. This approach may be advantageous since the costs of materials handling and some environmental impacts, such as energy use and disruption of the surrounding area, may be reduced.

Scientific Objective:

The U.S. Environmental Protection Agency's (EPA) Land Research Program in the Office of Research and Development (ORD) has made significant contributions to exploring innovative solutions to groundwater pollution problems and translating research results into practical applications. Scientists are evaluating the use of *in situ* treatment at hazardous waste sites and verifying innovative technologies. Research currently focuses on air sparging, thermal treatment, permeable reactive barriers, chemical treatment, bioremediation, phytoremediation, and monitored natural remediation. More information can be found at: www.frtr.gov/optimization/treatment/insitu.htm or http://clu-in.org. Technologies are tested by scientists in laboratories and with pilot-scale demonstration projects.

In situ processes can be used in combination with each other and with more conventional *ex situ* treatments to enhance their effectiveness. Removal rates and extent vary on the basis of contaminants and site-specific characteristics; contaminant distribution and concentration; co-contaminant concentrations; indigenous microbial populations and reaction kinetics; and soil parameters. Many of these factors are site dependent and can be difficult to manipulate. As a result, *in situ* treatment may not be uniform throughout the treatment area.

Application and Impact:
ORD's evaluation of new technologies and collaboration with EPA's regional offices has reduced remedial costs and improved effectiveness. Research contributions include:

- ORD scientists are continuing to investigate the fundamental and applied aspects of In Situ Chemical Oxidation (ISCO). ISCO introduces a chemical oxidant into the subsurface to transform groundwater or soil

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contaminants into less harmful chemical species. It is currently being used at new and old sites to reduce contaminant mass movement, off-site migration, mass input to pump-and-treat systems, and/or to reduce anticipated cleanup times. More information can be found at: www.epa.gov/ada/research.html#oxi.

- Scientists collaborate with EPA's regional offices to provide solutions to site-specific problems in states. One example is the Macalloy site in South Carolina. Ferrous sulfate was injected, in combination with sodium hydrosulfite, into a native aquifer formation in the path of a dissolved phase Cr(VI) plume. This pilot study illustrated that this solution provided sustained *in situ* treatment of dissolved phase Cr(VI) for a period of at least 1,020 days. More information can be found at: www.epa.gov/ada/research/waste/research_05.pdf.

- Scientists provide quick-response technical assistance to EPA's regional offices on site-specific problems at Superfund, Resource Conservation and Recovery Act (RCRA), Brownfields, and ecosystem restoration sites. More information about ongoing research efforts can be found at: www.epa.gov/ada/highlights.html

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Groundwater and ecosystem restoration research publications: www.epa.gov/ada/publications.html

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