



## LAND RESEARCH PROGRAM

### RESEARCH ADVANCES MONITORED NATURAL ATTENUATION (MNA) TECHNIQUES FOR EFFECTIVE SITE CLEANUP

**Issue:**

Natural attenuation is the reduction of contaminants in soil or ground water through natural physical, chemical, or biological processes. The processes degrade or dissipate contaminants and include aerobic and anaerobic biodegradation, dispersion, volatilization, and sorption. Natural attenuation can be used to remediate fuel components from leaking underground storage tanks, chlorinated solvents from hazardous waste sites, metals and other inorganic substances found in landfills, and spills of gasoline from service stations.

Monitored Natural Attenuation (MNA) is a technique used to monitor or test the progress of the attenuation process. It may be used with other remediation processes as a finishing option or as the only remediation process. Natural processes can then mitigate the remaining amount of

pollution, and regular monitoring of the soil and ground water can track those reductions. MNA is increasingly used in cleanup actions.

**Scientific Objective:**

The U.S. Environmental Protection Agency’s (EPA) Land Research Program in the Office of Research and Development (ORD) contributes to MNA scientific knowledge by:

- Conducting research to define attenuation mechanisms
- Exploring the use of MNA in multiple applications
- Developing recommendations and guidelines for evaluating attenuation processes
- Developing and evaluating site characterization tools and data requirements
- Measuring the rate of attenuation.

In addition to developing research products, the research program supports and transfers research results to the EPA regional offices and to state and municipal environmental organizations.

**Application and Impact:**

Researchers investigate the geochemical, hydrogeological, and microbiological factors that govern the performance and function of MNA applications. As performance evaluations are completed, scientists provide guidance to site managers. Research contributions include the following:

- Scientists synthesized research areas and published the “Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water.” This protocol provides guidance on the steps required to understand the rate and extent to which natural

*continued on back*

## LAND RESEARCH PROGRAM

*continued from front*

processes are reducing chlorinated solvents. The protocol is available at:

<http://www.epa.gov/superfund/health/conmedia/gwdocs/protocol.htm>.

- Scientists published the guidance, "Performance Monitoring of MNA Remedies for VOCs in Ground Water." This document is designed to be used during preparation/ design and review of long-term monitoring plans for sites. The guidance is available at: [www.epa.gov/ada/download/reports/600R04027/600R04027.pdf](http://www.epa.gov/ada/download/reports/600R04027/600R04027.pdf)
- Researchers reviewed the current state of knowledge on the transport and fate of the gasoline additive methyl tertiary-butyl ether (MTBE) in ground water. This document entitled, "Monitored Natural Attenuation of MTBE as a Risk Management Option at Leaking Underground Storage Tank Sites," emphasizes the natural processes that can be used to manage the risk associated with MTBE. The document is available at:

[www.epa.gov/ada/download/reports/600R04179/600R04179-fm.pdf](http://www.epa.gov/ada/download/reports/600R04179/600R04179-fm.pdf).

- In support of the EPA cleanup of the Industri-Plex industrial park site in Woburn, Massachusetts, scientists completed the "Industri-Plex Site Natural Attenuation Study." The study helped to characterize the nature of the ground water contamination fate upon discharge into an off-site surface water body and helped the Remedial Project Manager (RPM) develop the cost-savings remedy at the site.

Scientists also developed several models for use at cleanup sites to simulate natural attenuation remediation. Examples include the following:

**BIOSCREEN:** a screening model that simulates remediation through natural attenuation of dissolved hydrocarbons at petroleum fuel release sites. More information can be found at: [www.epa.gov/ada/csmos/models/bioscrn.html](http://www.epa.gov/ada/csmos/models/bioscrn.html).

**BIOCHLOR:** a screening model that simulates remediation by natural attenuation of dissolved solvents at chlorinated solvent release sites. More information can be found at:

[www.epa.gov/ada/csmos/models/biochlor.html](http://www.epa.gov/ada/csmos/models/biochlor.html).

**BIOPLUME III:** a 2-dimensional, finite difference model for simulating the natural attenuation of organic contaminants in ground water due to the processes of advection, dispersion, sorption, and biodegradation. More information can be found at:

[www.epa.gov/ada/csmos/models/bioplume3.html](http://www.epa.gov/ada/csmos/models/bioplume3.html).

**ANOTHER REFERENCE:**

Ground Water Models Web site: [www.epa.gov/ceampubl/gwater/index.htm](http://www.epa.gov/ceampubl/gwater/index.htm).

**CONTACT:**

Robert Puls, Ph.D., EPA's Office of Research and Development, U.S. Environmental Protection Agency, 580-436-8543, [puls.robert@epa.gov](mailto:puls.robert@epa.gov)

David Burden, Ph.D., EPA's Office of Research and Development, U.S. Environmental Protection Agency, 580-436-8606, [burden.david@epa.gov](mailto:burden.david@epa.gov)

John T. Wilson, Ph.D., EPA's Office of Research and Development, U.S. Environmental Protection Agency, 580-436-8534, [wilson.johnt@epa.gov](mailto:wilson.johnt@epa.gov)

**SEPTEMBER 2007**