



LAND RESEARCH PROGRAM

RESEARCH ADVANCES CLEANUP TECHNOLOGY WITH PERMEABLE REACTIVE BARRIERS (PRBS)

Issue:

Ground water 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. Permeable Reactive Barriers (PRBs) provide an *in situ* (at source) alternative that chemically or biologically removes or degrades specific contaminants in a plume of ground water. 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 has effectively demonstrated that PRBs are an established, cost-effective technology for ground water cleanup.

A PRB can either be a trench system excavated across the path of a ground water plume or a funnel-and-gate system that directs the flow through a gate containing reactive materials. PRBs have been applied to contaminated ground water plumes originating from a wide range of sites, such as mining, military, and industrial sites. Depending on the reactive materials used, research has shown that a PRB can effectively remove or reduce organics such as Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), and fuel hydrocarbon Dense Non-Aqueous Phase Liquids (DNAPLs). Scientists are exploring PRB application at sites contaminated

with inorganics such as radionuclides, metals (including arsenic and hexavalent chromium), and nutrients. This technology is also effective in reducing naturally occurring, elevated arsenic levels.

The Land Research Program provides technical reports and support to clients to enable scientifically sound and consistent decision making at Superfund and Resource Conservation and Recovery Act (RCRA) sites. PRB research includes the following:

- Evaluation of the long-term performance of PRBs in the field
- Field studies to advance applications of the technology
- Lab- and field-based studies to better understand basic processes that govern the performance and function of PRBs.

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Application and Impact:

The research program supports EPA by providing technical expertise on the application of PRBs at waste sites. Documents provide regulators with a scientific and economic framework for technology selection at impacted sites. Expertise and guidance include the following:

- **Long-Term Performance**

A unique feature of the research program is that long-term (>10 years) monitoring is performed at well-characterized sites. More information can be found at: www.epa.gov/ada/download/briefs/epa_600_s02_001.pdf.

- **Pilot-Scale PRBs**

Projects evaluate new applications of the PRB technology, such as untested reactive media or applications in complex hydrogeologic environments. More information can be found at: www.epa.gov/ada/topics/prb.html

- **Basic Processes Research**

ORD performs in-house studies of basic chemical, physical, and biological processes of

importance to PRB systems. These efforts typically result from field projects where knowledge gaps are identified.

Over the past decade, PRB technology has expanded rapidly in its use and acceptance as a viable approach for achieving site cleanup and closure. The primary reason for this expansion is that the technology results in cost-savings over alternative methods and because its performance has been extensively monitored by ORD scientists and others. More information on the extent of use of PRBs and their costs can be found at: www.epa.gov/ada/download/reports/epa_600_r02_034.pdf.

Results of the PRB long-term performance study were recently published in a synthesis of research findings from 10 years of research and development on PRBs. More information can be found at: www.epa.gov/ada/download/reports/600R03045A/600R03045a.pdf

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CONTACT:

Robert Puls, Ph.D., EPA's Office of Research and Development, U.S. Environmental Protection Agency, 580-436-8543, 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

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