

EDITOR:

James Mercer

MANAGING EDITOR:

Phyllis Korikow

COPY EDITOR:

Jacqueline Stanfill

OFFICE LOCATIONS:

ARIZONA

4665 S. Ash Avenue, Ste. G-1
 Tempe, AZ 85282
 602-839-2800
 602-839-2826 (FAX)

CALIFORNIA

3035 Prospect Park Drive, Ste. 40
 Rancho Cordova, CA 95670
 916-853-1800
 916-853-1890 (FAX)

COSTA MESA

3150 Bristol Street, Ste. 500
 Costa Mesa, CA 92626
 714-513-1415
 714-513-1276 (FAX)

COLORADO

9101 Harlan Street, Ste. 210
 Westminster, CO 80030
 303-426-7501
 303-426-7780 (FAX)

GEORGIA

1080 Holcomb Bridge Road
 Building 100, Ste. 190
 Roswell, GA 30076
 770-642-1000
 770-642-8808 (FAX)

MASSACHUSETTS

6 Lancaster County Road
 Harvard, MA 01451
 978-772-7557
 978-772-6183 (FAX)

NEVADA

Building B-1, Room 3050
 Mail Stop 439
 2621 Losen Road
 North Las Vegas, NV 89030
 702-295-2033
 702-295-2025 (FAX)

NEW YORK

50 W. Liberty Street, Ste. 500
 Reno, NY 89501
 702-324-5900
 702-324-5924 (FAX)

NEW JERSEY

2 Paragon Way
 Freehold, NJ 07728
 732-409-0344
 732-409-3020 (FAX)

VIRGINIA (Headquarters)

46050 Manekin Plaza, Ste. 100
 Sterling, VA 20196
 703-444-7000
 703-444-1685 (FAX)

WISCONSIN

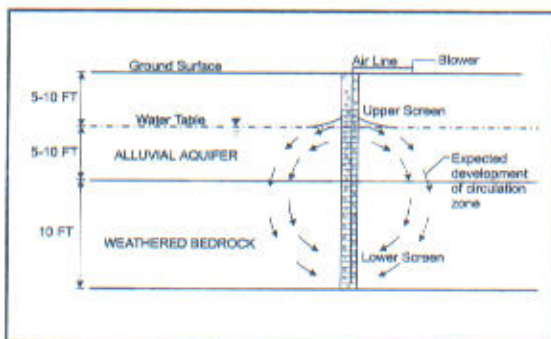
175 N. Corporate Drive, Ste. 100
 Brookfield, WI 53045
 414-792-1282
 414-792-1310 (FAX)

INTERNATIONAL

Santa Magdalena 72
 Oficina 203
 Providencia Santiago Chile
 011-562-232-1198
 011-562-232-7176 (FAX)

In-Situ Groundwater Bioremediation Using Dual-Density Convection (DDC) Wells

Dual-density convection well technology consists of a screened interval near the bottom of the well and a screened interval across the water table. An air line extends to the bottom of the well and a blower provides air under pressure. The air that enters the bottom of the well mixes with the water and creates a lower-density air/water mixture. This mixture rises to the top of the well, elevating the apparent water table before flowing laterally into the upper part of the aquifer. The water that moves laterally into the upper part of the aquifer is enriched in oxygen. Eventually, a convection cell forms and the circulated water is pulled back into the lower screen.



Pilot Study Conducted

HSI GeoTrans, working with Wasatch Environmental, Inc. and EMKO Environmental, conducted a dual-density convection well pilot study at an active wood treating plant in Denver, Colorado. The goal of the pilot study was in-situ bioremediation of dissolved polynuclear aromatic hydrocarbons (PAHs) and pentachlorophenol, and to optimize the cost effectiveness of the selected remedy. It was conducted to evaluate the effectiveness of the DDC well technology to distribute an electron-acceptor (in this case, oxygen) within the groundwater to stimulate in-situ bioremediation and contain site-related constituents. The target zone for the pilot test was alluvial material underlain by weathered bedrock. The total thickness of the alluvial unit ranges between 9 and 22 feet; at most locations the thickness of the alluvial cobbly-sand deposit

ranges between 7 and 11 feet. The groundwater table was approximately 5 to 10 feet below land surface.

The pilot system operated from December 19, 1996 to March 13, 1997, a total of 84 days. The test data demonstrated that the DDC system increases the dissolved oxygen in the groundwater and stimulates in-situ bioremediation.

Results

The extent of the circulation cells were defined based on the results of Rhodamine dye tracer data. The tracer results showed that the circulation cell had fully developed to a radius of 20 feet within 7 to 10 days of startup for the system. The extent of the bioremediation treatment zone may be less than the extent of the circulation cell due to limited transfer or high utilization of dissolved oxygen (DO). The data indicate that DO had reached all of the shallow monitoring points within approximately 3 weeks after startup of the pilot study. The DO appears to have been completely metabolized before circulating to the weathered bedrock at distances greater than 4 feet from the DDC well. Decreases in pentachlorophenol and PAH concentrations were observed throughout the shallow zone and within the weathered bedrock close to the DDC well. The utilization of DO and reductions in constituent concentrations demonstrate that the pilot study stimulated biological activity within the aquifer. The inorganic nutrient data show that critical nutrients, such as nitrogen and phosphorus, were initially present at low concentrations and were utilized rapidly during the pilot study. Emissions of volatile organics to the air from the DDC wells were negligible.

Implementation of in-situ bioremediation would replace an EPA approved design for an extensive pump-and-treat system projected to cost millions of dollars. HSI GeoTrans is continuing the DDC pilot well operation while exploring in-situ remediation technologies to achieve the most technically acceptable and cost-effective remedy.