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Lasagna™ Public-Private Partnership Completes Work

RTDF

Remediation Technologies Development Forum

Current RTDF Action Teams

- Bioremediation Consortium
- IINERT Soil-Metals Action Team
- Permeable Reactive Barriers Action Team
- Phytoremediation of Organics Action Team
- Sediments Remediation Action Team

The Lasagna™ Partnership, one of the original Action Teams of the Remediation Technologies Development Forum (RTDF), completed its work in 1999. The RTDF was created in 1992 by the U.S. Environmental Protection Agency (EPA) to foster collaboration between the public and private sectors in developing innovative solutions to mutual hazardous waste problems. Beginning the 1994, the Partnership—consisting of Monsanto, DuPont, General Electric, the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Energy (DOE)—jointly developed and tested the integrated, *in situ* remedial technology, referred to as the Lasagna™ Remediation Technology. The group's multi-year effort culminated in the selection and approval in 1998 of Lasagna™ for the commercial cleanup of a large contaminated cell at DOE's Paducah Gaseous Diffusion Plant (PGDP) at Paducah, Kentucky.

The Lasagna™ Process

Lasagna™ treats contaminated soil *in situ* by coupling electrically-driven transport of contaminants with *in situ* treatment processes. In a vertical configuration that has been successfully tested in the field, the planar electrodes consists of a mixture of granular carbon and iron filings, and are emplaced in the soil at the outer perimeter of the embedded contaminant. Several planar treatment zones are also emplaced at various intervals between the electrodes, directly into the contaminated zone. The contaminant is picked up in water and transported through the treatment zones in a process known as "electro-osmosis." The vertical configuration of the technology has been determined to be effective for remediation or "dechlorination" of trichloroethylene (TCE) in either low-permeability or mixed soils, and it is believed it will be effective for other contaminants as well. On a more limited scale, EPA also has successfully tested a horizontal configuration of the technology at Rickenbacker Air National Guard Base (ANGB) in Columbus, OH.

Accomplishments

Field tests of the vertical Lasagna™ process were conducted in test plots located at the PGDP. This site was chosen because a specific plot of soil at the plant had been contaminated with TCE, and the soil was low-permeable clay, for which Lasagna™ is uniquely suited. Operations were conducted in two phases: Phase I and Phase IIa. In Phase I, the treatment zones contained activated carbon in order to trap TCE from the soil. The operations began in January 1995 with a 10' X 15' X 15'

deep test cell. Phase I lasted several months, and over 99% of the TCE was successfully removed from the soil.

In Phase IIa, which began operations in the summer of 1996, a larger test cell was treated. The cell measured 21' X 30' X 45' deep. Also, iron filings were utilized in the treatment zones to dechlorinate TCE *in situ* instead of only trapping it as in Phase I. During Phase IIa, one or more zones, which contained unexpectedly large quantities of Dense Non-Aqueous Phase Liquid (DNAPL), were encountered. With an added six months of operations, the technology proved effective in treating the heavy concentrations of DNAPL, with most test sample locations cleaning up either below the required standard of 5.6 ppm or only marginally above it before power was shut down for soil sampling. Lasagna™ once again proved to be an effective technology for decontamination of TCE in low-permeability soils, even under heavy DNAPL conditions, which had been a key project objective.

Through the Rapid Commercialization Initiative (RCI), seven states, EPA, DOE, and the industrial members of the Partnership collaborated in the Phase IIa demonstration at PGDP. In March 1998, they signed a Verification Statement, indicating their acceptance of cost and performance data from the demonstration, facilitating regulatory acceptance of the technology.

Based on the success of the field tests, DOE selected the vertical Lasagna™ for cleanup of the entire Solid Waste Management Unit at PGDP and included it in the Record of Decision (ROD) submitted through the regulatory process. The ROD was approved in mid-summer 1998.

The Rickenbacker ANGB test of the horizontal configuration of Lasagna(tm) has been completed. Final sampling is pending. Test cells were 10 feet in diameter and were installed in soil containing trichloroethylene (TCE). One cell had treatment zones of zero-valent iron and the other had a biological treatment zone that was periodically flushed with methane to stimulate the methanotrophic bacteria that were inoculated into the treatment zone. These bacteria produce soluble methyl-monooxygenase, an enzyme that dechlorinates TCE. Another test cell served as a control for monitoring natural attenuation processes. The work at this site was successful in developing equipment and procedures for making electrical and hydraulic connection with hydraulic fracture electrodes (graphite) and treatment zones. The test demonstrated that horizontal Lasagna(tm) installations are feasible, can maintain electrokinetic and hydraulic transport of water and contaminants, and result in major dechlorination of TCE and daughter products. Additional testing is underway at Offutt Air Force Base in Omaha, NE.

Technical reports on the research, development, and testing of both configurations of the Lasagna™ process are available from the RTDF World Wide Web site.

Licensing Information

The Monsanto company, which holds two patents on the process, is now offering the vertical configuration of the Lasagna™ technology commercially through license agreements for treating soil contaminated with TCE or other "chlorinated aliphatic organics" at other locations. Prospective licensees or owners of contaminated sites may contact Dr. Sa V. Ho at Monsanto, (314) 469-5179, or Mr. John Merz at Monsanto Enviro-Chem, (314) 275-5738.

RTDF

Remediation Technologies Development Forum

Would You Like More Information?

For information on the RTDF or other Action Teams, please visit the RTDF World Wide Web site at www.rtdf.org or contact:

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