United States Environmental Protection Agency
Office of Research and Development Washington, DC 20460
Office of Solid Waste and Emergency Response Washington, DC 20460
EPA/540/F-93/510F
September 1993

EPA

Bioremediation Field Initiative Site Profile: Bendix Corporation/Allied Automotive Superfund Site

SITE FACTS

Location: St. Joseph, Michigan

Laboratories/Agencies: U.S. EPA Robert S. Kerr Environmental Research Laboratory (RSKERL), Western Region Hazardous Substance Research Center (WRHSRC) at Stanford University, U.S. EPA Region 5, Michigan Department of Natural Resources

Media and Contaminants: Vinyl chloride (VC), dichloroethylene (DCE), and trichloroethylene (TCE) in ground water

Treatment: In situ bioremediation

Date of Initiative Selection: Fall 1990

Objective: To evaluate the in situ remediation of VC and TCE contamination in ground water

Bioremediation Field Initiative Contact: John Wilson, U.S. EPA RSKERL, P.O. Box 1198, Ada, OK 74820

Regional Contact: John Kuhns, U.S. EPA Region 5, Waste Management Division, 77 West Jackson Boulevard, Chicago, IL 60604

Background

In 1982, two contaminated ground water plumes with mg/L concentrations of trichloroethylene (TCE), vinyl chloride (VC), and *cis*- and *trans*-1,2-dichloroethylene (*c*- and *t*-DCE) were found to be emanating from the Bendix Corporation/Allied Automotive industrial site in St. Joseph, Michigan (see Figure 1), and the site was placed on the National Priority List. In early 1991, the Western Region Hazardous Substance Research Center (WRHSRC) at Stanford University, in cooperation with U.S. EPA Region 5 and the U.S. EPA Robert S. Kerr Environmental Research Laboratory (RSKERL), began a series of studies to examine the feasibility of a proposed in situ treatment for the contaminated ground water.

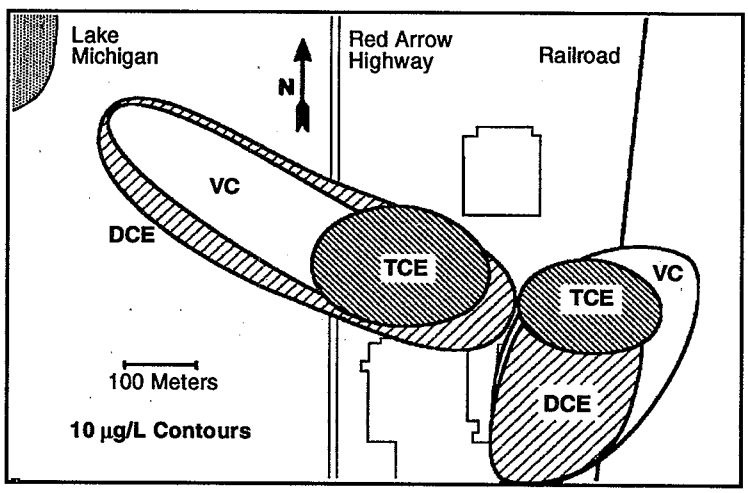

Figure 1. Plan view of site, showing contaminated plumes of TCE, VC, and DCE.

Field Evaluation

Researchers previously had discovered that *c*-DCE, *t*-DCE, and VC could be biodegraded in situ by mixing ground water and a solution of oxygen and methane. In the field, however, simply injecting solutions of oxygen and methane into an aquifer does not adequately mix them with the contaminated ground water. To remedy this problem, WRHSRC proposed using an in situ treatment unit that enhances this

mixing. Figure 2 presents a schematic of this system. The unit consists of a well with two screens, a pump, and mixing apparatus. One well screen is located at the bottom of the aquifer and the other

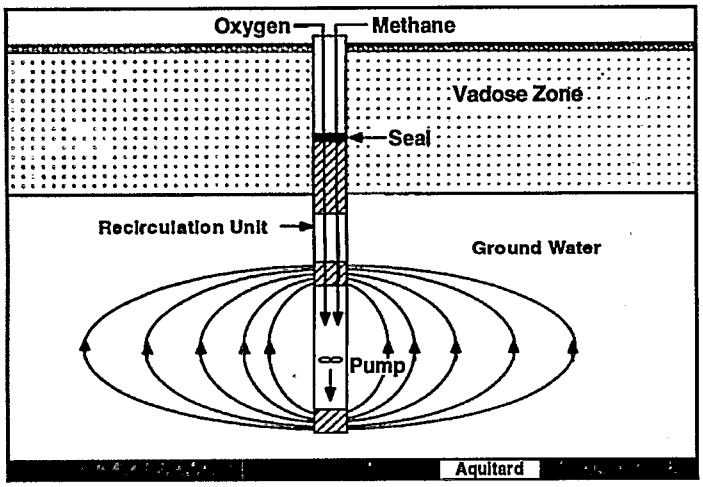

Figure 2. Schematic of the mixing and recirculation system.

is at the water table. Contaminated ground water is drawn into the well through the lower screen, where oxygen and methane are added, then pumped back into the aquifer through the water table screen. The pumping rate in the treatment unit can be adjusted to recirculate the plume through the treatment unit as many times as is necessary to meet cleanup standards.

RSKERL began by sampling and chemically analyzing two transects extending across the plume perpendicular to the flow of ground water. These samples revealed relatively high concentrations of all contaminants within 20 m of the plume's center. Maximum concentrations were 138 mg/L for TCE, 128 mg/L for *c*-DCE, and 56 mg/L for VC. Concentrations of TCE were much higher than expected, leading researchers to suspect that TCE might inhibit the growth of methanotrophic bacterial populations needed to remediate the aquifer.

To investigate this possibility, WRHSRC conducted microcosm studies of aquifer solids. The microcosms showed complete methane utilization regardless of VC or TCE concentration and removal rates of 25 to 80 percent for VC. The studies also showed, however, that TCE is not effectively transformed by the methanotrophic process. Based on these results, WRHSRC speculated that the proposed mixing system might actually dissolve more TCE than it degraded by circulating ground water past highly concentrated, oily-phase TCE. This led WRHSRC to recommend that the proposed system be installed only in areas where TCE concentrations are low and VC is the downgradient contaminant.

Status

Researchers currently are conducting another site characterization to identify regions of the contaminated site with low concentrations of TCE. Previous research has shown that low concentrations of TCE can be transformed in situ to environmentally benign ethene by adding methanol and acetate to the aquifer. A combination of this treatment for TCE and the originally proposed methanotrophic treatment for VC might be used to remediate regions of the site with low TCE concentrations.

The Bioremediation Field Initiative was established in 1990 to expand the nation's field experience in bioremediation technologies. The Initiative's objectives are to more fully document the performance of full-scale applications of bioremediation; provide technical assistance to regional and state site managers; and provide information on treatability studies, design, and operation of bioremediation projects. The Initiative currently is performing field evaluations of bioremediation at eight other hazardous waste sites: Libby Ground Water Superfund site, Libby, MT; Park City Pipeline, Park City, KS; West KL Avenue Landfill Superfund site, Kalamazoo, MI; Eielson Air Force Base Superfund site, Fairbanks, AK; Hill Air Force Base Superfund site, Salt Lake City, UT; Escambia Wood Preserving Site—Brookhaven, Brookhaven, MS; Reilly Tar and Chemical Corporation Superfund site, St. Louis Park, MN; and Public Service Company, Denver, CO. To obtain profiles on these additional sites or to be added to the Initiative's mailing list, call 513-569-7562. For further information on the Bioremediation Field Initiative, contact Fran Kremer, Coordinator, Bioremediation Field Initiative, U.S. EPA, Office of Research and Development, 26 West Martin Luther King Drive, Cincinnati, OH 45268; or Michael Forlini, U.S. EPA, Technology Innovation Office, Office of Solid Waste and Emergency Response, 401 M Street, SW., Washington, DC 20460.