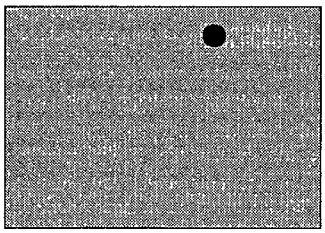
United States Environmental Protection Agency | Office of Research and Development Washington, DC 20460 | Office of Solid Waste and Emergency Response Washington, DC 20460

EPA/540/F-93/510D | September 1993

EPA

Bioremediation Field Initiative Site Profile: Public Service Company of Colorado

SITE FACTS



Location: Denver, Colorado

Laboratories/Agencies: U.S. EPA Robert S. Kerr Environmental Research Laboratory (RSKERL), U.S. EPA Region 8

Media and Contaminants: BTEX in ground water

Treatment: In situ bioremediation of ground water with nutrient and hydrogen peroxide addition

Date of Initiative Selection: Spring 1991

Objective: To evaluate the effectiveness of in situ bioremediation of used oil and the potential for future environmental impact from residual contaminants

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

Regional Contact: Suzanne Stevenson, U.S. EPA Region 8, 999 18th Street, Denver, CO 80202-2466

Background

In 1987, Public Service Company of Colorado (PSC), an electric utility, determined that used oil had leaked from a 75-gallon tank at the company's facility at 2701 West 7th Avenue in Denver, Colorado. The tank served as a temporary catch basin for used automotive oil in the facility's garage. A discrepancy between the volume of oil deposited in the tank and the volume pumped out for disposal lead PSC to suspect the leak. Though it is unclear when the leak first occurred, the tank had been in service for 29 years before the leak was discovered. The Bioremediation Field Initiative has conducted a retrospective evaluation of the performance of in situ bioremediation of oil leaked from the tank.

Characterization

PSC found soil concentrations of oil and grease beneath the tank ranging up to 9,600 mg/kg. Soil samples also showed BTEX compounds in the following concentrations: toluene, 3,200 µg/kg; ethyl benzene, 820 µg/kg; and xylenes, 29,600 µg/kg. Ground water sampling detected low levels of BTEX compounds, though levels of xylenes exceeded EPA's proposed drinking water standards.

Field Evaluation

In July 1989, PSC installed an in situ bioremediation system to remediate the contaminated ground water and promote biodegradation of contaminants in the soil above and below the water table and in the aquifer. The treatment took place in several stages. First, ground water was pumped from a recovery well downgradient of the leaking tank at the rate of 11 gallons per minute to ensure the capture and content of contaminants. The recovered water then was treated by carbon adsorption to remove dissolved hydrocarbons before being pumped to a nutrient gallery. In the nutrient gallery, the ground water was amended twice: first with ammonium and phosphate compounds to provide inorganic nutrients; then with hydrogen peroxide to increase the water's level of dissolved oxygen. The amended ground water

was then reinjected upgradient of the leaking tank, thereby delivering the nutrients and oxygen needed to sustain aerobic biodegradation in the saturated zone. Figure 1 is a computer-generated model of ground water flow from the injection wells to the recovery well. Figure 2 shows the actual flow of nutrients beneath the leaking oil tank.

To speed remediation of the contaminated soil in the vadose zone, PSC also added batches of nutrients directly to the soil and installed a bioventing system to induce a dynamic flow of ambient air above the water table to highly contaminated areas in the subsurface.

Status

By 1991, concentrations of BTEX in the monitoring wells were approaching the cleanup goals. In

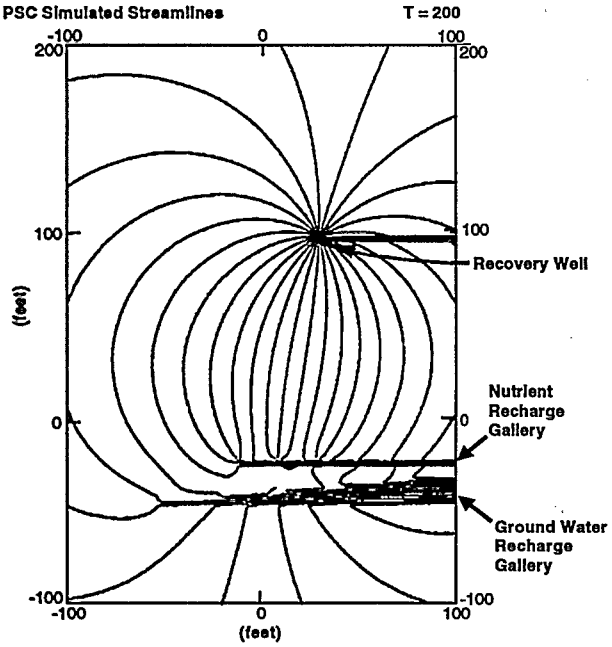


Figure 1. Computer-generated model of ground water flow from injection wells to recovery well.

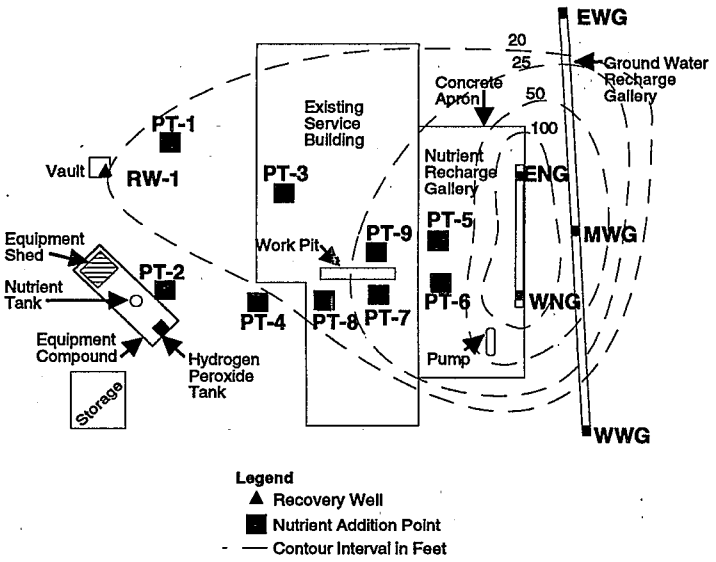


Figure 2. Schematic of site showing flow of nutrients in ground water under leaking tank.

March of 1992, PSC submitted an application for closure to the State of Colorado. The site currently is in the monitoring phase. In July of 1992, the U.S. EPA Robert S. Kerr Environmental Research Laboratory (RSKERL) conducted an evaluation of the site, including soil coring to determine the quantity and distribution of residual oil downgradient of the leaking tank, chemodynamic modeling to predict the maximum concentration of BTEX that could partition from residual oil to ground water, and hydrogeologic monitoring to predict the concentration of BTEX in a hypothetical well at the site boundary downgradient of the leaking tank. The results of this evaluation still are being analyzed, but RSKERL's interim conclusion is that, while some hydrocarbons remain at the site, they are not contributing at this time to substantial contamination of ground water in the aquifer.

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; Bendix Corporation / Allied Automotive Superfund site, St. Joseph, MI; 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; and Reilly Tar and Chemical Corporation Superfund site, St. Louis Park, MN. 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.