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

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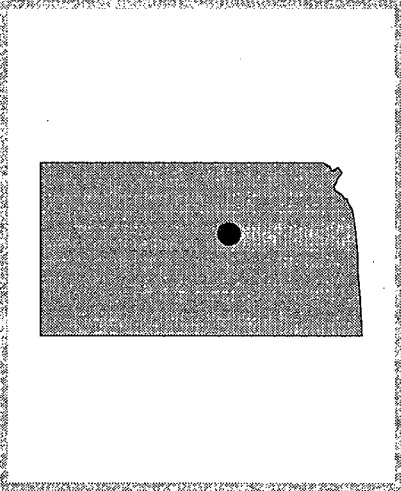
EPA

Bioremediation Field Initiative Site Profile: Park City Pipeline

SITE FACTS



Location: Park City, Kansas

Laboratories/Agencies: U.S. EPA Robert S. Kerr Environmental Research Laboratory (RSKERL), U.S. EPA Region 7

Media/Contaminants: Refined petroleum (BTEX) in ground water

Treatment: BTEX fermentation, BTEX denitrification, BTEX denitrification supplemented with oxygen

Date of Initiative Selection: Spring 1991

Objective: To evaluate the relative effectiveness of three technologies for treating refined petroleum hydrocarbons from a leaking pipeline

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Background

In the 1970s, a buried pipeline at an oil refinery in Park City, Kansas, started leaking a variety of refined petroleum products and petroleum feedstocks into the water table aquifer. By February 1980, the spill had contaminated ground water near Park City's municipal well #6. To intercept the flow of hydrocarbons from the pipeline to the well, two trenches were excavated to the water table for free product recovery. As a means of disposal, the petroleum in the trenches occasionally was set afire. The west trench was backfilled in August 1982; the east trench was filled in August 1984. The U.S. EPA Robert S. Kerr Environmental Research Laboratory (RSKERL) is performing a field evaluation of three treatments for the contaminated ground water.

Characterization

In 1989, 18 monitoring wells and two sets of five piezometers were installed to define the extent of contamination and the direction of ground water flow. In spring of 1991, 12 more monitoring wells and two sets of piezometers were added to better define the distribution of the oil. The contamination is in the floodplain of the Arkansas River, where 15 to 20 ft of clay overlie a sand aquifer (see Figure 1). The water table is near the interface of the sand and the clay, and the bedrock is

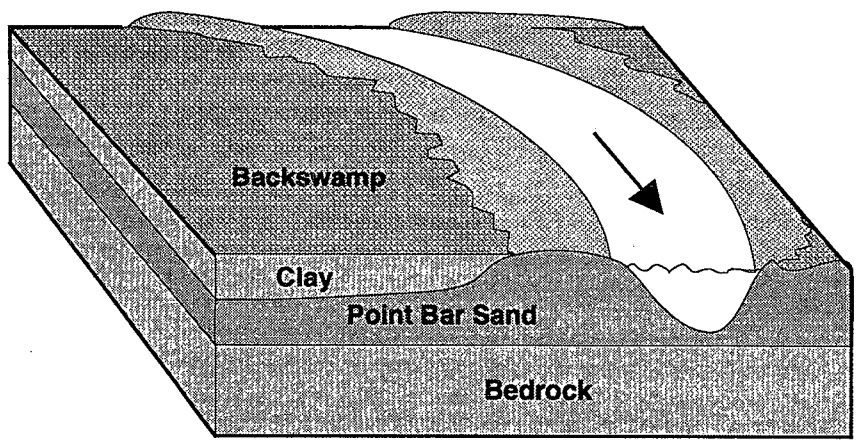

Figure 1. Geological setting of the site.

45 to 50 ft below the surface. Hydrocarbon contamination is confined roughly to an interval between the base of the clay layer and the top of the present water table (see Figure 2).

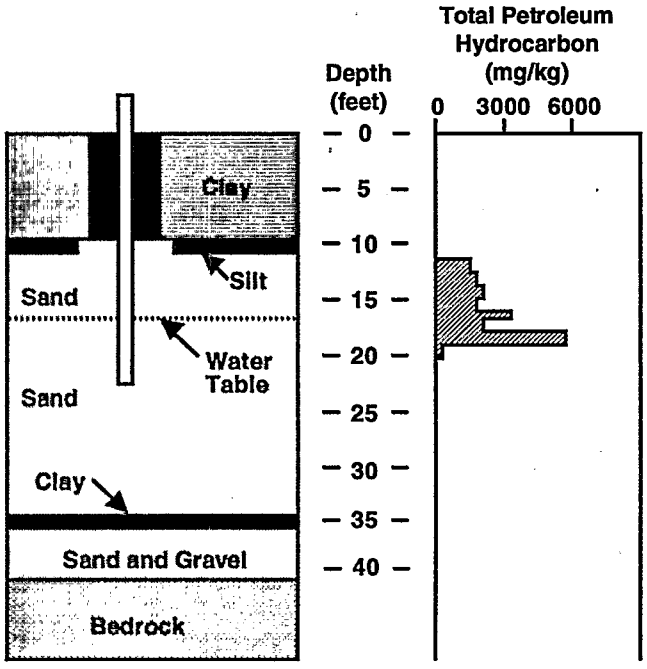

Figure 2. Relationship among spilled hydrocarbons, layers of geological materials, the water table, and monitoring wells.

Field Evaluation

In 1990, more than 400 shallow injection wells were installed at the site. These wells are constructed on a 20-ft grid and cover the entire area affected by the spill. Researchers have divided an area affected by the homogeneous fuel spill into three discrete blocks of about 1 acre each and are applying one of the following experimental treatments to each block:

- BTEX fermentation alone
- BTEX denitrification alone
- BTEX denitrification supplemented with oxygen

Water from a municipal supply well is pumped to the surface, amended, and recirculated to the aquifer through the injection wells. Each of the three experimental plots receives approximately 125 gpm. At that rate, the water is estimated to require an average of 6.4 days to recirculate. To maintain the demonstration in a cone of depression, water also is being pumped from a second nearby well.

The water distributed to all three plots is amended with ammonium chloride at 5 mg/L. Two plots also receive nitrate at 10 mg/L as nitrogen. The third plot receives oxygen at 2 mg/L. To act as a tracer, and to enable researchers to estimate the volume of water in the recirculation loop, the recirculated water is amended with sodium bromide at 50 mg/L.

Status

Researchers have completed microcosm studies on the two denitrification technologies to predict the duration of remediation required. Aquifer core samples from two locations originally showed average BTEX concentrations of 42.6 mg/kg and 24.3 mg/kg, respectively. Toluene, ethylbenzene, *m*-xylene, *p*-xylene, 1,3,5-trimethylbenzene, and 1,2,4-trimethylbenzene degraded to less than 5 µg/L within 20 days in the clean aquifer microcosms amended with nitrate. About half of the *o*-xylene was removed. Benzene and 1,2,3-trimethylbenzene were recalcitrant. Based on these findings, researchers predict that 210 days of treatment will be required to supply enough nitrate to remediate the aquifer. Remediation began in December 1992.

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; 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; 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.